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WEATHER BUREAU — F. W. Reichelderfer, Chief

MONTHLY WEATHER REVIEW

JULY 1942

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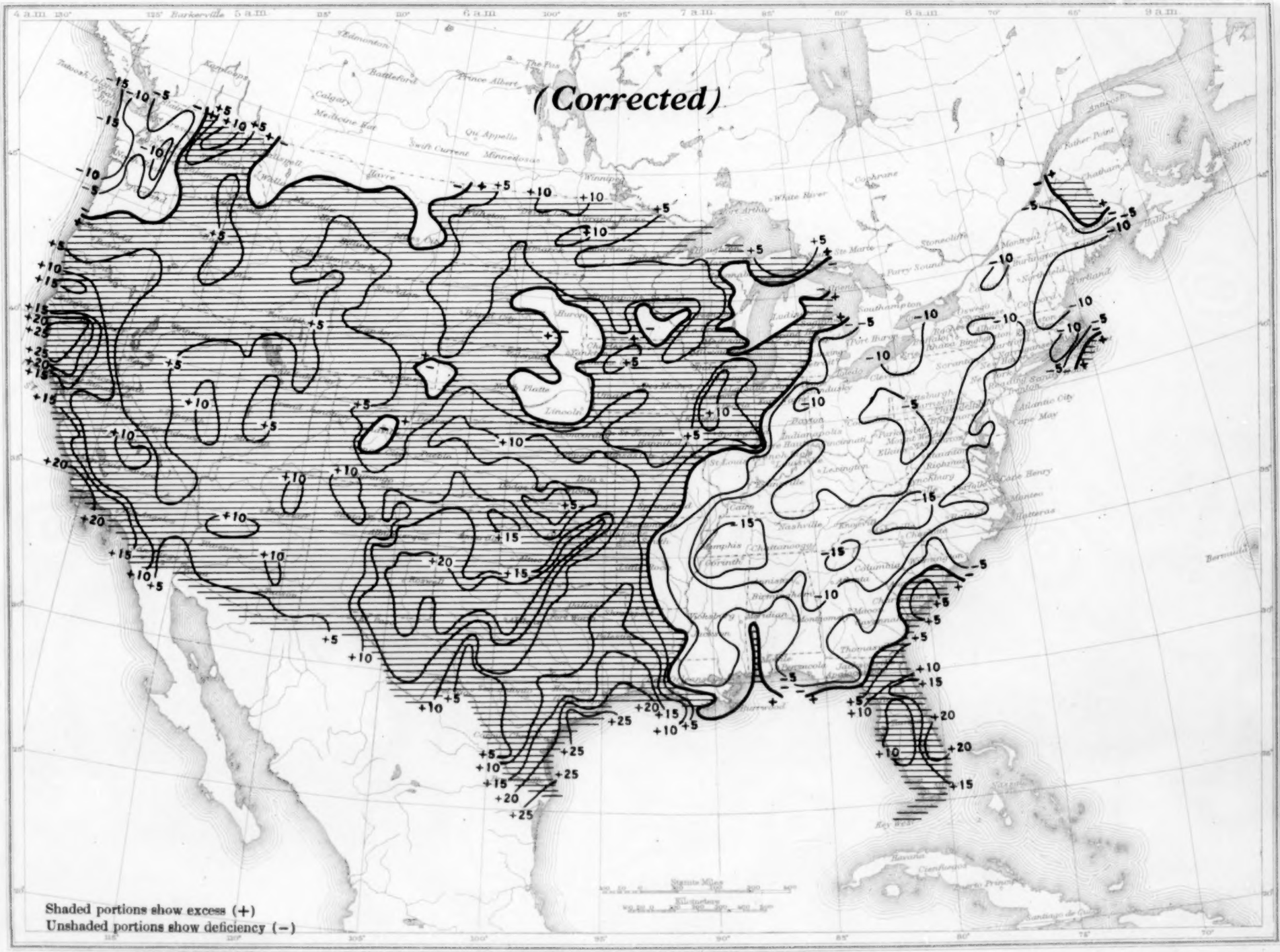
CORRECTION

MONTHLY WEATHER REVIEW, December 1941, vol. 69: On the chart facing page 361, the precipitation departure figures for Nevada should be "+5" and "+10", since the entire State had plus departures for the year in question. A corrected loose chart is enclosed in this issue.

Annual Precipitation Departures (inches) in the United States, 1941

(Corrected)



Recipients of the December 1941 MONTHLY WEATHER REVIEW are requested to replace Chart of Annual Precipitation Departures in the United States for 1941, facing page 361, in that issue, which was incorrectly printed, by the corrected chart herewith.

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UNITED STATES OF AMERICA
OCT 27 '42

MONTHLY WEATHER REVIEW

Editor, EDGAR W. WOOLARD

VOL. 70, No. 7
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HOURLY DISTRIBUTION AND INTENSITY OF PRECIPITATION AT KANSAS CITY, MO.

By HOWARD H. MARTIN

[Weather Bureau, Kansas City, Mo., November 1941]

The climatic records of Kansas City, in the heart of the Midwestern agricultural belt, are to be considered as representative of the greater part of that area, especially northwestern Missouri, northeastern Kansas, southwestern Iowa and southeastern Nebraska. It is not surprising, therefore, to find that the distribution of precipitation in the Kansas City area is of the type most favorable to plant growth, i. e., predominantly during nighttime hours. Considering the year as a whole, 64 percent of measurable precipitation falls between sunset and sunrise, and 77 percent falls between 11 p. m. and 11 a. m. (See fig. 1.) A study of figure 2 shows a rather sharp line of demarcation between the distribution during the dormant, or winter season, and during the vegetal, or growing season. During the dormant period there is but a slight variation of frequency throughout the 24 hours, the maximum being between 3 and 4 a. m. However, during the vegetal period, with the maximum frequency at sunrise, 88 percent of the hours with measurable precipitation are between 11 p. m. and 11 a. m. A study of figure 3, showing the distribution of precipitation by months, reveals that January shows two periods of maximum frequency, the major between 3 a. m. and 6 a. m. with a minor between 11 a. m. and 12 noon, and a definite period of minimum frequency between 7 and 9 p. m. In February the distribution is even more equable, with maxima at 3 a. m. and 4 p. m. and minima at 7 p. m. and 9 p. m.

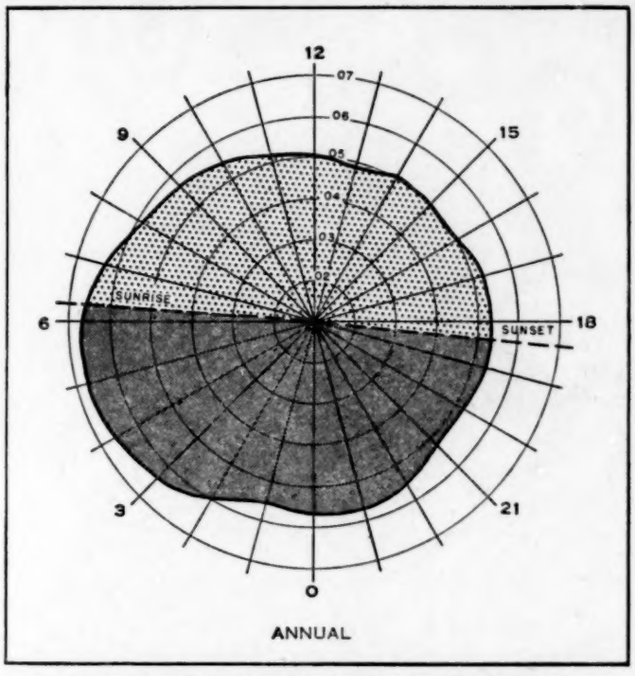

FIGURE 1.—Hourly distribution of precipitation throughout the day, entire year considered, at Kansas City, Mo., 1911–40.

Although March maintains a fairly equable distribution, there is now first evidence of a swing to summer trend. A definite maximum period of frequency between 5 and 7 a. m., and a minimum between 9 and 10 p. m. are indicated. April is the first month to show the frequency common to the vegetal period, with a prominent maximum between 5 and 6 a. m., and an equally pronounced minimum between 3 and 5 p. m. In April, 82 percent of the hours with measurable precipitation fall between 9 p. m. and 9 a. m.

While throughout the greater part of the year a preponderance of the measurable precipitation occurs during nighttime, in May the preponderance swings into the daylight period. With maxima at 4 a. m. and at 7 a. m., and a definite minimum at noon, 73 percent of hours with measurable rainfall lie between 11 p. m. and 11 a. m. June, also, shows a pronounced tendency toward daylight hours, 70 percent of the hours with precipitation falling between midnight and noon, with a frequency maximum between 4 a. m. and 7 a. m., and a minimum at 1 p. m. In July, but 38 percent of hours with measurable rainfall lie between sunset and sunrise, and a vast preponderance (86 percent) between the hours of 10 p. m. and 10 a. m. with a pronounced frequency maximum at 6 a. m., and minima at 11 a. m., 2 p. m. and 9 p. m.

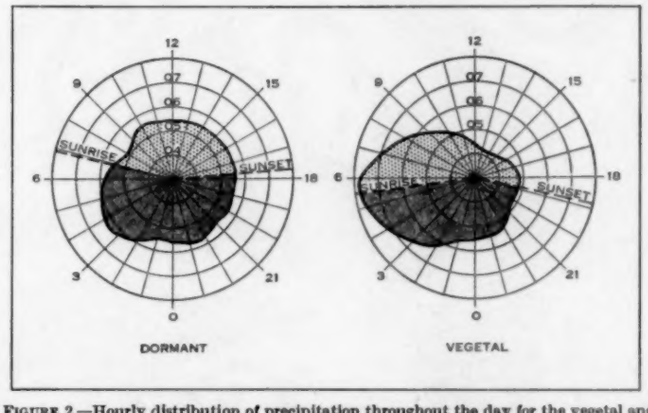

FIGURE 2.—Hourly distribution of precipitation throughout the day for the vegetal and dormant seasons of the year at Kansas City, Mo., 1911–40.

In August, hours with precipitation are again more frequent between sunset and sunrise, although 82 percent of the total lie between 10 p. m. and 10 a. m., with a definite frequency maximum at 6 a. m. and a minimum between 3 and 4 p. m. In September, although the bulk of hours with rainfall lie during the night period, 91 percent of these hours lie between 11 p. m. and 11 a. m., with a definite frequency maximum at 6 a. m. and a minimum from 3 to 9 p. m.

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In October, there is a tendency to revert to the distribution common to the dormant period. Maxima occur at 5 a. m. and at 9–10 a. m., with minima at 2 p. m. and from 12–1 p. m. In November, a fairly equable distribution prevails with a frequency maximum 9–10 p. m. and a minimum at 9 a. m. In December, maxima are recorded at 3 p. m. and from 1–2 a. m., with minima at 7 a. m. and 7 p. m.

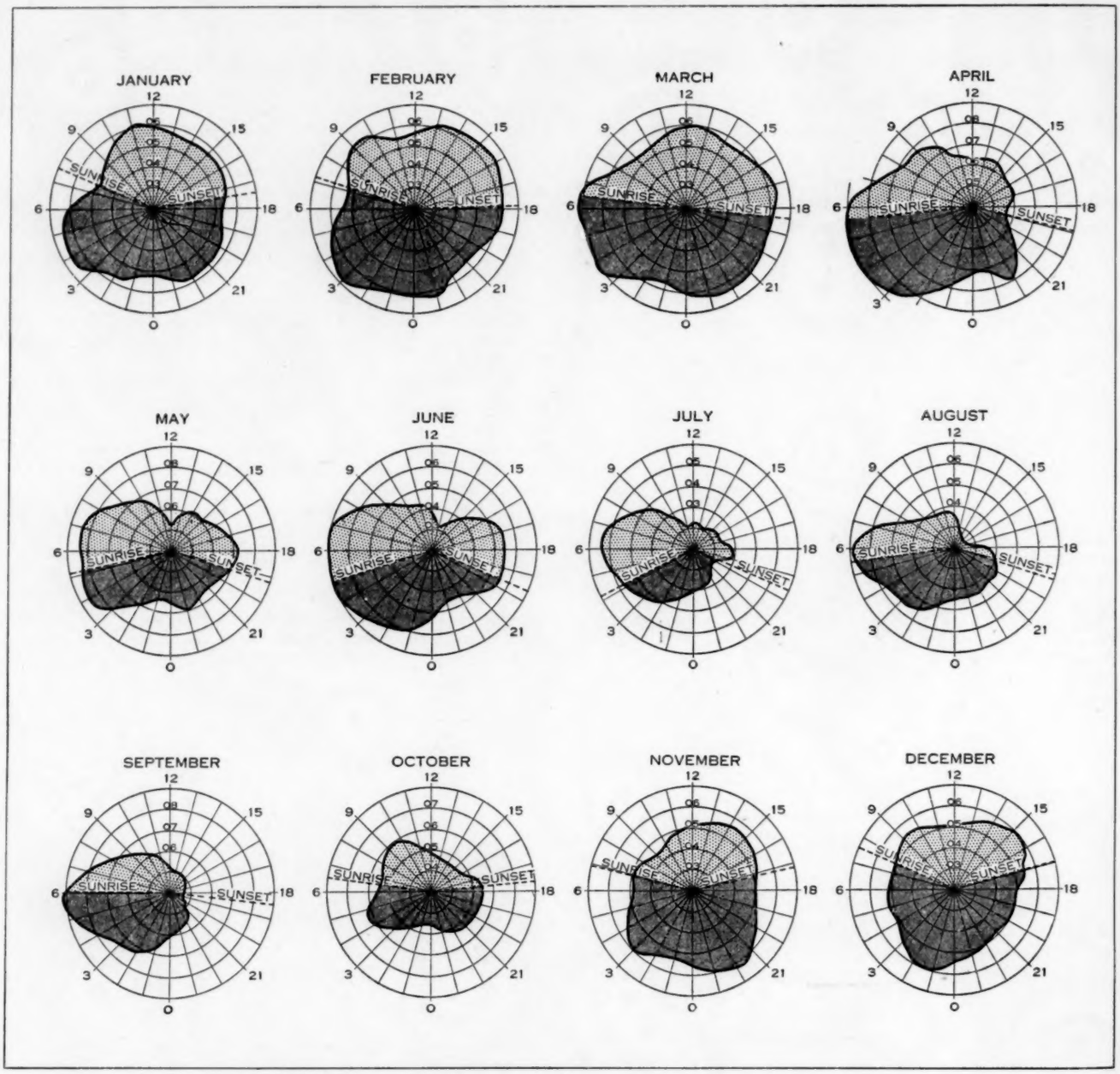

FIGURE 3.—Distribution of measurable precipitation throughout the day, by months, at Kansas City, Mo., 1911–40.

Figure 4 presents these distribution values in terms of number of times measurable rain was actually recorded; and figure 5 in actual amounts of rainfall measured for the several hours during the 30-year period of study.

Tables 1 to 4 are self-explanatory. In table 2 it is to be noted that the percentage value tabulated is the relation of the times that measurable precipitation actually occurred to the times possible in the 30-year period, while in table 3 the relation is between the times that measurable precipitation was recorded and the total hours of precipitation for the month within the period of study. In preparing the data for presentation, they were smoothed by the formula $\frac{a+2b+c}{4}$ in order to emphasize their salient characteristics and to eliminate or reduce sporadic fortuitous variations.

In the study of intensities and their distribution it is to be noted, from figures 6, 7, and 8, that there is no apparent relation between the period of maximum intensity and the period of greatest frequency. In fact, it is for the most

part true that throughout the year the maximum intensity, or greatest fall of rain per hour, occurs at or near the period of minimum frequency. Compare the two figures for April, May, July, August, and October, especially. From January to June the heaviest rainfall occurs during the daylight hours. In July the maximum intensity centers about 11 p. m., the secondary maximum in June lying between midnight and 2 a. m. In August the two maxima are at night, at 8 p. m. and 2 a. m., with a third period of intensity at 11 a. m. In September, the two maxima are at 3 a. m. and 8 a. m., while in October there is a definite shift the other way, with maxima at 10 p. m. and 5 p. m. In November and December the period of maximum intensity returns to daylight hours, being at 3 p. m. in November and at 7 a. m. in December.

Table 5 presents these data in actual values, and table 6 shows the heaviest hourly recording for each month of the period studied.

For purposes of local forecasting, the past data on distribution of precipitation may prove of value. For instance, there are no definite periods of maximum frequency in January, February and March; but in April, measurable precipitation is 30 percent more frequent between 2 and 7 a. m. than between 5 and 8 p. m. In May, measurable rain is 25 percent more likely between 3 and 4 a. m. than 11 a. m. and noon. In June, the relative frequency of precipitation between 2 and 7 a. m. is 62 percent, while between 12 noon and 1 p. m. it is but 30 percent, a difference of 32 percent. In July, measurable rain is 32 percent more likely between 5 and 6 a. m. than between 11 a. m. and 3 p. m., and in August 29 percent more between 4 and 6 a. m. than between 1 and 5 p. m. In September, precipitation is 38 percent more frequent between 4 and 6 a. m. than between 4 and 8 p. m., while in October it is but 26 percent more likely between 4 and 7 a. m. than between 3 and 5 p. m.

In November and December the intensities as well as the distribution return to the equable character of the winter months. As a rule, whenever precipitation of measurable amount is to be expected in the Kansas City area at all, the probabilities appear to be heavily in favor of its fall during the early morning hours. Afternoon precipitation is more infrequent but heavier, on an average, although a study of the excessive values (1.00 inch or more per hour) will show a fairly even distribution around the clock, with a minimum in the early afternoon, and maxima at several points from 6 p. m. to 10 a. m.

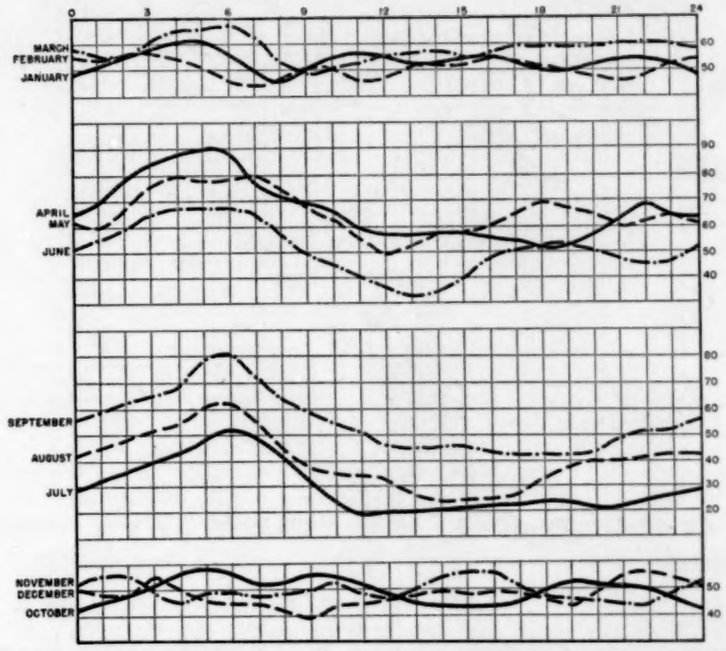

FIGURE 4.—Hourly relative frequency of precipitation at Kansas City, Mo., by months, in terms of percentage of average number of hourly recordings, 1911–40.

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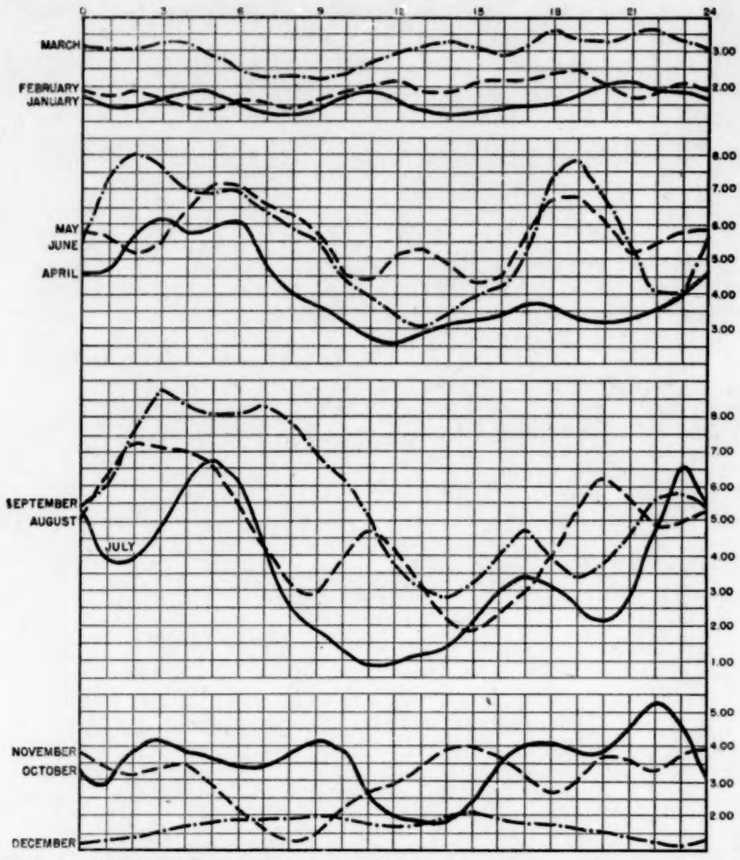

FIGURE 5.—Distribution of precipitation at Kansas City, Mo., hourly by months, in terms of total amount of precipitation recorded, 1911–40.

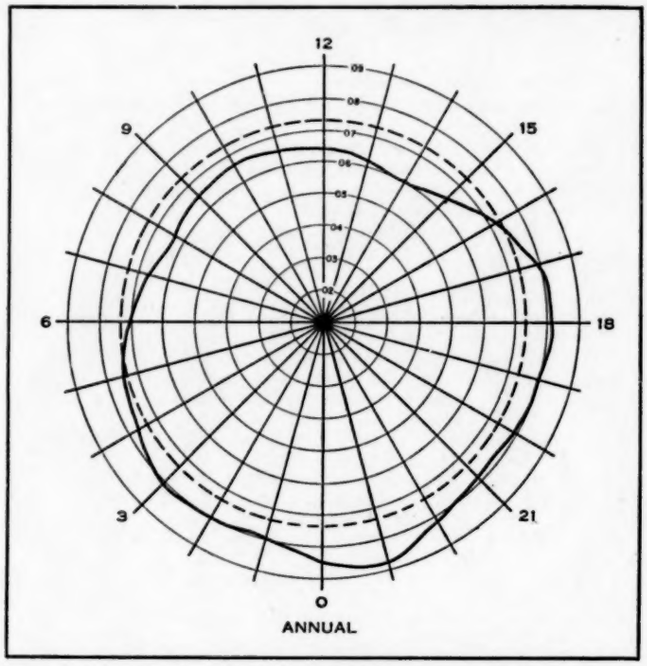

FIGURE 6.—Hourly intensity of precipitation, full yearly records, at Kansas City, Mo., 1911–40.

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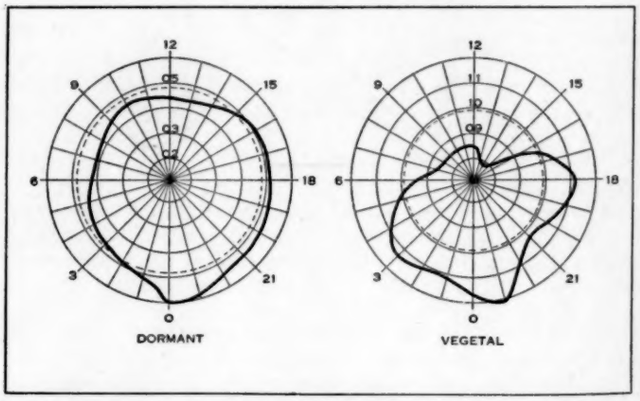


FIGURE 7.—Hourly intensi y of precipitation at Kansas City, Mo., during the vegetal and dormant seasons of the year, 1911–40.

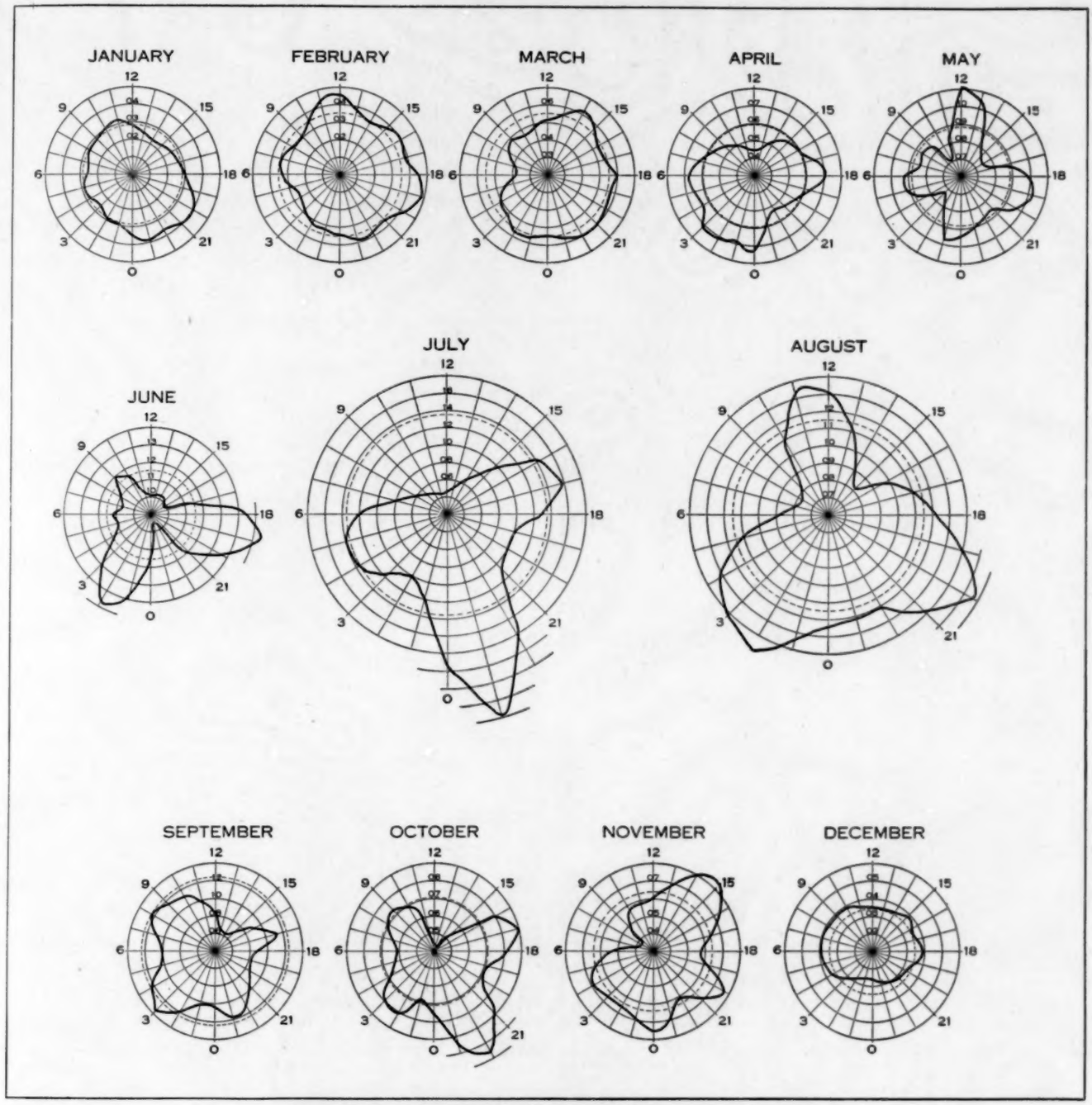


FIGURE 8.—Hourly intensity of precipitation by months at Kansas City, Mo., 1911–40.

TABLE 1.—*Showing the number of times measurable precipitation has occurred during each hour of the day, for the period of record, 1911 to 1940*

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	48	58	55	64	59	62	47	39	52	53	60	56	51	51	55	56	50	53	46	53	52	57	50	49
February	49	58	57	56	51	45	43	46	54	51	44	44	54	52	51	56	51	54	50	51	44	47	55	55
March	52	51	63	67	61	67	69	47	49	49	54	53	59	52	54	55	60	60	57	60	58	63	60	60
April	67	80	85	86	90	95	77	63	75	65	57	57	55	60	52	54	59	46	52	53	62	72	67	60
May	54	68	73	85	77	74	85	72	67	62	61	38	55	61	51	64	62	72	64	62	59	61	69	61
June	54	54	60	64	64	61	66	52	49	37	43	33	28	31	40	41	53	45	52	51	43	42	39	51
July	31	38	40	43	48	53	52	39	36	23	15	12	21	17	24	20	21	26	25	20	18	29	25	29
August	44	51	51	50	65	66	54	41	36	36	35	33	27	22	25	22	25	33	39	40	40	41	42	40
September	60	64	65	65	82	85	71	63	60	53	54	45	43	45	47	41	44	41	42	41	49	51	52	51
October	42	49	51	60	57	56	50	49	60	55	50	48	45	42	44	41	45	48	56	48	51	52	47	40
November	48	46	54	53	42	43	46	40	38	41	46	43	51	47	49	49	49	46	43	50	53	59	51	51
December	56	55	50	44	52	45	48	45	52	53	48	43	51	55	55	57	50	45	48	46	45	39	52	47

TABLE 2.—*Showing the distribution of measurable precipitation by hourly percentage of the total number of hours possible, for the period, 1911 to 1940, inclusive*

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	5.2	6.2	5.9	6.9	6.3	6.7	5.1	4.2	5.6	5.7	6.4	6.0	5.5	5.5	5.9	6.0	5.4	5.7	4.9	5.7	5.6	6.1	5.4	5.3
February	5.2	6.9	6.8	6.7	6.1	5.4	5.2	5.5	6.4	6.1	5.2	5.2	6.4	6.2	6.1	6.7	6.1	6.4	6.0	6.1	5.2	5.6	6.5	6.5
March	5.6	5.5	6.8	7.2	6.6	7.2	7.4	5.1	5.3	5.3	5.8	5.7	6.3	5.6	5.8	5.9	6.4	6.4	6.1	6.4	6.2	6.8	6.4	6.4
April	7.4	9.0	9.4	9.6	10.0	10.6	8.6	7.0	7.7	7.3	6.3	6.3	6.1	6.7	5.8	6.0	6.6	5.1	5.8	5.9	6.9	8.0	7.5	6.7
May	5.8	7.3	7.8	9.1	8.3	8.0	9.1	7.7	7.2	6.7	6.6	4.1	5.9	6.6	5.5	6.9	6.7	7.7	6.9	6.7	6.3	6.6	7.4	6.6
June	6.0	6.0	6.7	7.1	7.1	6.8	7.3	5.8	5.4	4.0	4.8	3.7	3.1	3.3	4.4	4.5	6.0	5.0	5.8	5.7	4.8	4.7	4.3	5.7
July	3.3	4.1	4.3	4.6	5.2	5.7	5.6	4.2	3.9	2.5	1.6	2.4	2.3	1.8	2.6	2.2	2.3	2.8	2.7	2.2	1.9	3.1	2.7	3.1
August	4.7	5.5	5.5	5.4	7.0	7.1	5.8	4.4	3.9	3.9	3.8	3.5	2.9	2.4	2.7	2.4	2.7	3.5	4.2	4.3	4.3	4.4	4.5	4.3
September	6.7	7.1	7.3	7.3	9.1	9.4	8.0	7.0	6.7	6.0	6.0	5.0	4.8	5.0	5.2	4.6	4.9	4.6	4.7	4.6	5.4	5.7	5.8	5.7
October	4.5	5.3	5.5	6.4	6.1	6.0	5.4	5.3	6.4	5.9	5.4	5.2	4.8	4.5	4.7	4.4	4.8	5.2	6.0	5.2	5.5	5.6	5.1	4.3
November	5.3	5.1	6.0	5.9	4.7	4.8	5.1	4.5	4.2	4.5	5.1	4.8	5.7	5.2	5.4	5.4	5.4	5.1	5.1	5.5	6.0	6.2	5.9	5.6
December	6.0	5.9	5.4	4.7	5.6	4.8	5.2	4.8	5.6	5.7	5.2	4.6	5.5	5.9	5.9	6.1	5.4	4.8	5.2	4.9	4.8	4.2	5.6	5.1
Year	5.5	6.2	6.5	6.7	6.9	6.9	6.5	5.5	5.7	5.3	5.2	4.7	4.9	4.9	5.0	5.1	5.2	5.2	5.3	5.3	5.2	5.6	5.6	5.4

TABLE 3.—*Showing the distribution of measurable precipitation by hourly percentages of the total hours recorded, for period, 1911 to 1940, inclusive, Kansas City, Mo.*

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	3.8	4.5	4.3	5.0	4.6	4.9	3.7	3.1	4.1	4.2	4.7	4.4	4.0	4.0	4.3	4.4	3.9	4.2	3.6	4.2	4.1	4.5	3.9	3.8
February	4.0	4.8	4.7	4.6	4.2	3.7	3.5	3.8	4.4	4.2	3.6	3.6	4.4	4.3	4.2	4.6	4.2	4.4	4.1	4.2	3.6	3.8	4.5	4.5
March	3.8	3.7	4.6	4.9	4.4	4.9	5.0	3.1	3.6	3.6	3.9	3.8	4.3	3.7	3.9	4.0	4.3	4.3	4.1	4.3	4.2	4.6	4.3	4.3
April	4.2	5.0	5.3	5.4	5.7	5.9	4.8	4.0	4.7	4.1	3.6	3.6	3.5	3.8	3.3	3.4	3.7	2.9	3.3	3.3	3.9	4.5	4.2	3.8
May	3.5	4.4	4.7	5.5	4.9	4.8	5.5	4.6	4.3	4.0	3.9	2.4	3.5	3.9	3.3	4.1	4.0	4.6	4.1	4.0	3.8	3.9	4.4	3.9
June	4.7	4.7	5.2	5.6	5.6	5.3	5.7	4.5	4.2	3.2	3.7	2.9	2.4	2.7	3.5	3.6	4.6	3.9	4.5	4.4	3.7	3.6	3.4	4.4
July	4.3	5.3	5.6	6.0	6.7	7.4	7.4	5.5	5.0	3.2	2.1	3.1	3.1	2.4	3.4	2.8	3.1	3.6	3.5	2.8	2.5	4.1	3.5	4.1
August	4.6	5.3	5.3	5.2	6.8	6.9	5.6	4.3	3.8	3.8	3.7	3.4	2.8	2.3	2.6	2.3	2.6	3.3	4.1	4.2	4.2	4.3	4.4	4.2
September	4.6	4.9	4.9	4.9	6.2	6.5	5.4	4.8	4.6	4.0	4.1	3.4	3.3	3.4	3.6	3.1	3.3	3.1	3.2	3.1	3.7	3.9	4.0	3.9
October	3.5	4.1	4.3	5.1	4.8	4.7	4.2	4.1	5.1	4.6	4.2	4.0	3.8	3.5	3.7	3.5	3.8	4.0	4.7	4.0	4.3	4.4	4.0	3.4
November	4.2	4.0	4.7	4.7	3.7	3.8	4.0	3.5	3.3	3.6	4.0	3.8	4.5	4.1	4.3	4.3	4.3	4.0	3.8	4.4	4.7	5.2	4.5	4.5
December	4.7	4.7	4.2	3.7	4.4	3.8	4.1	3.8	4.4	4.5	4.1	3.6	4.3	4.7	4.7	4.8	4.2	3.8	4.1	3.9	3.8	3.3	4.4	4.0
Year	4.2	4.6	4.8	5.0	5.2	5.2	4.9	4.1	4.3	3.9	3.8	3.5	3.7	3.6	3.7	3.8	3.8	3.8	3.9	3.9	3.9	4.2	4.1	4.1

TABLE 4.—*Showing the distribution of measurable precipitation by hourly totals, Kansas City, Mo., period 1911 to 1940, inclusive*

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	1.41	1.57	1.34	1.89	1.84	1.53	1.18	1.14	1.36	1.65	2.07	1.54	1.21	1.29	1.15	1.61	1.36	1.52	1.53	2.33	2.09	1.80	2.08	1.55
February	1.52	2.05	1.55	1.40	1.43	1.42	1.66	1.33	1.55	1.84	1.84	2.46	1.73	1.62	2.23	2.12	1.95	2.40	2.81	1.77	1.62	1.81	2.28	1.75
March	3.48	2.60	3.46	3.51	2.71	2.46	2.28	2.49	2.24	2.19	2.87	2.71	3.15	3.43	3.21	2.72	2.74	4.32	2.84	3.54	3.53	3.45	3.93	2.48
April	4.06	5.55	7.28	4.46	6.40	6.68	4.53	3.92	3.71	3.31	2.72	2.50	2.59	3.32	2.91	3.03	3.91	3.58	3.23	2.94	3.62	3.31	3.68	5.20
May	6.14	4.48	5.72	6.09	7.74	7.06	6.49	6.07	6.77	3.18	4.90	4.96	5.65	4.91	4.23	4.03	5.63	7.36	6.06	7.18	3.69	6.21	5.48	5.86
June	7.72	8.28	7.71	6.93	6.45	7.67	6.15	5.91	5.63	4.84	3.68	3.61	2.75	3.07	4.49	3.40	5.30	7.71	8.83	6.07	6.01	3.30	3.52	5.65
July	2.34	4.59	3.83	6.61	6.93	6.37	4.57	1.79	2.20	1.48	0.43	0.92	1.30	0.95	1.99	3.14	3.63	3.48	2.14	2.25	1.48	5.32	7.41	5.89
August	6.00	8.32	6.61	7.33	6.94	5.14	4.83	2.50	3.10	2.99	6.37	3.28	3.69	1.66	1.80	2.36	2.64	4.01	5.17	7.17	5.53	4.43	5.43	4.61
September	6.34	7.07	9.89	7.86	8.18	8.01	7.94	9.07	5.70	7.33	4.80	3.87	3.02	2.29	3.75	2.92	6.38	2.87	3.77	3.28	4.44	5.96	6.44	4.53
October	2.13	4.38	4.65	3.14	4.26	2.98	3.42	3.68	4.10	4.45	2.43	1.86	2.01	1.39	2.18	3.76	4.04	4.18	3.75	3.22	4.31	6.16	4.60	2.98
November	3.41	2.92	3.49	3.65	3.12	1.97	1.74	1.12	1.07	2.29	2.80	2.29	3.90	3.64	4.35	3.50	3.21	2.29	2.48	4.54	3.33	3.01	3.85	3.96
December	1.43	1.24	1.69	1.60	1.78	1.86	1.87	1.82	1.96	2.05	1.73	1.65	1.65	1.80	2.25	1.79	1.68	1.84	1.62	1.55	1.38	1.30	1.07	1.26
Year	3.83	4.42	4.77	4.54	4.82	4.43	3.89	3.40	3.28	3.13	3.05	2.64	2.72	2.45	2.88	2.86	3.54	3.80	3.70	3.82	3.42	3.84	4.15	3.81

TABLE 5.—*Showing the intensity of hourly precipitation, Kansas City, Mo., period 1911 to 1940, inclusive (expressed in thousandths of an inch)*

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	0.029	0.027	0.025	0.028	0.031	0.025	0.025	0.029	0.026	0.031	0.035	0.027	0.024	0.024	0.021	0.028	0.027	0.029	0.033	0.044	0.040	0.032	0.042	0.032
February	.031	.035	.027	.025	.028	.033	.039	.030	.029	.036	.042	.056	.032	.031	.044	.038	.038	.044	.056	.035	.037	.038	.042	.032
March	.065	.051	.055	.052	.044	.037	.033	.053	.046	.045	.053	.051	.053	.066	.060	.050	.046	.072	.050	.059	.061	.055	.067	.041
April	.061	.069	.086	.052	.071	.070	.059	.062	.050	.051	.047	.044	.047	.055	.056	.057	.066	.077	.062	.056	.059	.046	.055	.087
May	.114	.066	.078	.071	.100	.095	.077	.084	.100	.051	.080	.131	.103	.080	.083	.063	.091	.102	.095	.116	.064	.102	.079	.096
June	.143	.154	.129	.109	.100	.126	.093	.114	.115	.131	.086	.110	.098	.099	.112	.083	.100	.171	.170	.119	.140	.079	.090	.111
July	.075	.121	.096	.154	.144	.120	.088	.046	.053	.065	.029	.042	.062	.056	.083	.157	.173	.135	.086	.112	.082	.183	.298	.203
August	.134	.163	.130	.147	.107	.078	.090	.061	.086	.083	.182	.100	.137	.075	.072	.107	.106	.122	.133	.179	.138	.108	.129	.115
September	.106	.110	.152	.121	.099	.098	.112	.144	.095	.138	.089	.086	.070	.051	.085	.071	.145	.070	.090	.080	.091	.117	.128	.089
October	.051	.089	.091	.052	.075	.053	.068	.075	.068	.081	.049	.039	.045	.033	.049	.092	.090	.087	.067	.067	.085	.119	.097	.075
November	.071	.064	.065	.069	.074	.046	.039	.028	.054	.056	.058	.053	.076	.077	.089	.072	.066	.050	.058	.091	.063	.051	.076	.078
December	.026	.023	.034	.034	.034	.041	.039	.040	.038	.039	.036	.038	.032	.033	.041	.032	.034	.041	.034	.034	.031	.034	.021	.027
Year	.077	.081	.081	.076	.076	.068	.066	.064	.064	.067	.067	.065	.065	.057	.066	.071	.082	.083	.078	.083	.074	.080	.094	.082

TABLE 6.—*Showing the maximum amounts of precipitation recorded by hours at Kansas City, Mo., for the period 1911 to 1940, inclusive. The maximum precipitation for any hour within the period was 2.94 inches in September 1914. The maximum precipitation for any hour of record at Kansas City was 4.79 inches in August 1906*

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	0.16	0.14	0.13	0.15	0.24	0.15	0.13	0.15	0.20	0.15	0.24	0.20	0.26	0.11	0.08	0.32	0.17	0.19	0.26	0.48	0.15	0.12	0.15	0.15
February	.17	.20	.13	.11	.18	.20	.16	.11	.11	.10	.24	.30	.18	.13	.19	.16	.20	.60	.45	.31	.23	.27	.39	.13
March	.38	.27	.31	.52	.17	.32	.28	.32	.20	.16	.33	.24	.24	.31	.22	.35	.15	1.15	.21	.50	.31	.31	.37	.22
April	.58	.99	.60	.42	.93	.42	.34	.32	.27	.17	.21	.23	.18	.25	.25	.25	.88	.56	.56	.41	.77	.86	.86	.72
May	1.47	.50	.33	.83	1.38	.67	1.12	1.12	1.57	.36	.53	1.00	.50	.64	.39	.67	.77	1.10	.63	1.12	.43	.53	.54	.80
June	1.35	1.15	.43	.46	.56	1.79	1.48	.65	.87	2.28	.86	.89	.93	.61	1.00	.98	.79	1.48	1.42	1.14	.74	.36	.89	.96
July	.40	1.01	.52	1.15	1.90	1.24	.55	.24	.23	.46	.15	.25	.36	.20	.23	.58	.93	.64	.67	.70	.39	.99	2.62	1.92
August	.84	1.75	1.08	1.26	1.00	.70	1.45	.40	.49	.94	1.50	.62	.75	.56	.38	.53	.46	.76	.94	1.03	1.06	.56	1.07	.67
September	.84	.82	1.33	1.36	.58	.84	1.86	2.57	1.11	1.04	.35	.57	.46	.35	.66	.48	.93	.25	.78	.52	.63	.40	1.17	.40
October	.21	.55	.61	.27	.62	.35	.33	.72	.58	.52	.35	.63	.39	.33	.25	.43	54.	.57	.40	.38	1.67	1.65	.62	.79
November	.28	.30	.47	.41	.34	.80	.46	.28	.23	.26	.32	.31	.34	.37	.67	.50	.31	.25	.20	.54	.40	.36	.67	.42
December	.10	.09	.20	.22	.34	.37	.17	.33	.17	.45	.21	.15	.18	.10	.24	.19	.16	.26	.33	.19	.15	.20	.35	.16
Year	1.47	1.75	1.33	1.36	1.90	1.79	1.86	2.57	1.57	2.28	1.50	1.00	.93	.64	1.00	.98	.93	1.48	1.42	1.14	1.67	1.65	2.62	1.92

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR JULY 1942

[Climate and Crop Weather Division, J. B. KINCER, in charge]

AEROLOGICAL OBSERVATIONS

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1942*

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																							
	Albuquerque, N. Mex. (1,620 m.)				Atlanta, Ga. (300 m.)				Bismarck, N. Dak. (505 m.)				Boise, Idaho (864 m.)				Brownsville, Tex. (6 m.)				Buffalo, N. Y. (221 m.)				Caribou, Maine (191 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	29	840	26.1	32	31	984	24.2	83	31	955	20.2	78	31	914	25.6	32	30	1,016	26.6	87	31	990	19.4	79	29	991	15.1	83
500					31	962	24.8	76									30	961	24.8	84	31	958	19.4	73	29	955	16.6	68
1,000					31	909	22.6	72	31	902	19.5	65	31	900	27.7	29	30	908	22.4	66	31	904	16.9	70	29	901	14.1	65
1,500					31	858	19.3	74	31	851	16.5	65	31	850	25.5	27	30	857	20.0	60	31	853	13.8	73	29	849	10.8	67
2,000	29	805	24.7	33	31	809	16.0	73	31	801	13.6	62	31	803	21.5	27	30	808	17.0	57	31	803	10.7	67	29	799	7.6	70
2,500	29	760	21.0	34	31	763	12.9	72	31	756	10.7	59	31	757	17.2	28	30	762	14.1	56	31	756	8.2	56	28	752	4.9	67
3,000	29	717	17.1	35	31	719	10.0	72	31	711	7.5	56	31	714	13.0	30	30	718	11.4	54	31	712	5.7	53	28	707	2.4	63
4,000	29	637	8.7	42	31	637	4.5	68	31	630	1.3	51	31	632	5.3	34	30	636	5.9	50	30	629	.7	49	28	624	−2.4	52
5,000	29	564	.8	51	31	563	−1.0	64	31	555	−5.3	47	31	559	−2.2	37	30	563	.4	47	29	555	−5.0	45	28	550	−8.2	49
6,000	29	497	−6.6	57	31	496	−6.7	62	31	488	−11.7	43	31	492	−9.5	38	30	496	−5.7	45	29	488	−11.3	40	27	483	−14.3	45
7,000	29	437	−12.9	56	31	436	−13.2	60	31	428	−18.9	40	31	431	−16.9	37	28	436	−11.8	43	28	428	−17.8	39	27	422	−21.4	43
8,000	29	382	−19.8	53	31	381	−19.8	58	31	372	−26.3	39	28	377	−24.5	36	27	382	−18.9	43	28	373	−24.7	38	27	368	−28.8	42
9,000	28	333	−26.8	51	31	332	−26.7	57	28	324	−33.7	39	28	328	−32.1	36	27	332	−26.0	42	27	324	−31.5	38	27	319	−36.1	42
10,000	28	290	−34.3	50	31	289	−34.1	55	28	280	−41.0	----	27	284	−39.2	35	25	289	−33.7	42	25	282	−38.6	36	27	276	−42.8	----
11,000	28	251	−42.1	----	30	250	−42.0	----	28	241	−47.7	----	25	245	−45.8	----	25	250	−41.8	----	22	243	−45.8	----	26	238	−48.0	----
12,000	28	216	−49.3	----	30	215	−49.6	----	28	207	−52.2	----	23	210	−51.0	----	24	215	−50.0	----	21	209	−51.9	----	26	204	−51.4	----
13,000	28	185	−55.8	----	30	184	−57.1	----	28	177	−54.9	----	22	180	−54.2	----	23	184	−57.8	----	21	179	−55.9	----	25	175	−53.4	----
14,000	25	158	−61.8	----	29	157	−63.2	----	28	151	−56.8	----	20	154	−56.7	----	22	157	−64.8	----	20	152	−58.4	----	24	150	−54.5	----
15,000	23	134	−66.0	----	28	133	−66.5	----	26	129	−58.5	----	17	131	−59.7	----	22	133	−69.7	----	18	130	−60.2	----	23	128	−55.8	----
16,000	21	114	−68.6	----	28	113	−67.9	----	22	110	−58.8	----	16	112	−61.8	----	21	112	−72.5	----	17	111	−61.1	----	22	110	−56.2	----
17,000	20	96	−69.1	----	26	96	−66.8	----	18	94	−58.6	----	14	95	−61.4	----	17	94	−73.1	----	14	94	−60.6	----	16	94	−55.8	----
18,000	19	81	−66.7	----	25	81	−64.9	----	14	80	−58.0	----	14	81	−59.3	----	16	80	−71.4	----	12	80	−59.1	----	10	80	−55.0	----
19,000	16	69	−63.5	----	21	69	−62.3	----	6	68	−55.9	----	11	69	−57.2	----	13	67	−68.6	----	5	68	−57.8	----	----	----	----	----
20,000	12	59	−60.8	----	8	59	−59.3	----	----	----	----	----	7	59	−55.5	----	10	56	−64.4	----	----	----	----	----	----	----	----	----
21,000	7	50	−57.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1942*

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Charleston, S. C. (14 m.)				Denver, Colo. (1,616 m.)				Detroit, Mich. (194 m.)				El Paso, Tex. (1193 m.)				Ely, Nev. (1,908 m.)				Great Falls, Mont. (1129 m.)				Huntington, W. Va. (172 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,016	25.5	91	31	842	20.2	54	31	990	19.6	84	31	883	26.8	39	31	811	22.9	22	31	888	20.4	49	31	997	22.0	91
500	31	962	25.8	69					31	957	20.9	71													31	960	23.2	76
1,000	31	909	22.9	67					31	903	18.2	68													31	906	20.7	71
1,500	31	858	19.6	70					31	852	14.9	68	31	853	27.1	36					31	851	19.9	45	31	856	17.4	71
2,000	31	809	16.1	72	31	805	20.9	47	31	802	11.8	66	31	805	23.9	35	31	803	24.0	22	31	803	16.9	44	31	803	14.1	68
2,500	31	763	12.9	69	31	759	17.8	45	31	756	9.3	55	31	760	19.5	38	31	758	22.1	22	31	757	13.1	46	31	760	11.1	65
3,000	31	718	10.0	66	31	716	14.0	46	31	712	6.5	51	31	717	15.1	42	31	715	17.8	22	31	713	9.1	50	31	715	8.1	61
4,000	31	637	4.2	64	31	635	6.3	55	31	629	1.2	45	31	636	6.7	54	31	635	8.8	25	31	631	1.9	56	31	634	3.2	50
5,000	30	562	−1.3	59	31	562	−1.2	67	31	556	−4.7	44	31	562	−.8	65	31	562	0.0	31	30	556	−5.1	55	31	559	−2.4	44
6,000	30	496	−6.9	53	31	495	−8.3	68	29	488	−10.6	40	30	496	−7.7	69	31	495	−9.0	40	30	489	−12.0	53	31	492	−8.5	40
7,000	28	436	−13.1	51	30	434	−15.1	61	28	428	−17.3	38	27	435	−13.8	63	31	434	−15.7	41	30	429	−19.2	51	31	432	−14.6	38
8,000	27	381	−19.8	49	30	379	−22.2	57	28	374	−24.6	38	27	381	−20.4	57	31	379	−22.3	38	30	374	−26.7	50	31	378	−21.6	38
9,000	27	332	−27.1	48	30	330	−29.7	56	27	325	−31.6	38	26	332	−27.6	54	31	330	−29.7	36	30	325	−34.3	49	31	329	−28.8	38
10,000	27	289	−34.5	46	30	286	−37.2	53	27	282	−39.0		25	288	−35.4	53	31	287	−37.0	35	30	281	−42.2		31	286	−36.4	37
11,000	26	250	−42.4		30	247	−45.0		26	243	−46.1		25	249	−43.3		29	247	−43.9		30	242	−49.0		31	247	−43.9	
12,000	26	215	−50.3		30	212	−52.0		25	208	−51.2		25	214	−51.2		25	213	−50.1		30	207	−52.8		31	212	−51.2	
13,000	26	184	−58.1		30	182	−57.7		25	178	−55.0		24	183	−58.2		25	183	−55.9		30	177	−54.2		31	181	−57.7	
14,000	24	157	−64.8		29	155	−61.8		23	152	−57.4		24	156	−63.8		24	156	−60.5		30	152	−55.3		31	154	−62.1	
15,000	22	133	−69.3		27	131	−65.6		22	130	−59.6		23	132	−67.5		23	132	−64.0		30	130	−57.2		31	131	−65.0	
16,000	21	113	−68.9		27	111	−67.0		22	111	−60.9		21	112	−70.1		20	112	−65.9		29	111	−58.1		28	112	−65.6	
17,000	19	95	−67.1		21	94	−66.6		18	94	−60.1		21	95	−69.2		19	95	−65.6		28	94	−58.2		25	94	−64.2	
18,000	13	81	−64.5		20	80	−64.0		13	80	−58.0		15	80	−66.9		16	81	−63.6		24	81	−57.3		18	80	−62.5	
19,000	10	68	−61.4		13	68	−61.3		7	68	−56.4		9	68	−64.3		12	69	−61.0		20	76	−55.8		16	68	−60.6	
20,000					7	57	−58.5						5	58	−61.6		8	58	−58.5		16	59	−54.4		7	57	−58.8	
21,000																					12	50	−53.2					
22,000																					7	43	−52.1					

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Joliet, Ill. (178 m.)				Lake Charles, La. (5 m.)				Lakehurst, N. J.[1] (39 m.)				Medford, Oreg. (401 m.)				Miami, Fla. (4 m.)				Nashville, Tenn. (180 m.)				Norfolk, Va.[1] (4 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	994	21.1	82	31	1017	25.7	89	31	1011	21.7	81	31	967	26.2	38	30	1019	26.0	85	30	996	25.5	76	30	1016	26.0	79
500	31	959	23.0	70	31	961	24.6	73	31	959	22.1	62	31	956	25.8	39	30	963	24.6	81	30	961	25.6	69	30	961	24.4	69
1,000	31	905	20.0	68	31	908	22.1	69	31	906	19.4	56	31	903	22.4	43	30	910	21.8	73	30	908	22.8	67	30	908	22.0	65
1,500	31	854	16.6	69	31	857	19.5	62	31	854	16.2	56	31	852	18.6	49	30	859	18.9	68	30	857	19.4	71	30	857	18.8	67
2,000	31	805	13.7	68	31	808	16.7	59	31	805	12.9	58	31	803	15.1	56	30	810	16.2	63	30	808	16.0	72	30	808	15.6	65
2,500	31	758	10.7	66	31	762	13.8	56	31	759	10.4	57	31	757	12.2	61	30	764	13.4	56	30	762	12.9	72	30	762	12.6	64
3,000	31	714	7.9	64	31	718	11.1	54	31	714	7.7	54	31	713	9.8	52	30	720	10.3	53	30	718	9.9	67	30	717	10.0	62
4,000	31	632	2.1	61	31	637	5.6	50	31	632	2.3	47	31	632	3.6	40	30	637	4.3	52	29	636	4.4	57	30	634	4.4	53
5,000	31	558	−3.8	54	31	563	−.2	52	31	558	−2.9	46	31	558	−2.7	39	30	563	−1.7	53	29	562	−1.4	54	29	560	−1.4	50
6,000	31	491	−10.4	52	31	496	−6.1	52	30	491	−8.9	47	31	491	−9.2	38	30	496	−7.4	48	29	495	−7.5	47	25	494	−7.6	50
7,000	31	431	−17.1	49	31	436	−12.5	50	30	431	−15.0	48	31	431	−16.7	35	30	436	−13.6	45	29	435	−13.9	42	23	434	−13.7	48
8,000	31	376	−24.1	48	30	382	−19.4	49	29	376	−21.8	44	31	376	−24.5	34	30	381	−20.3	44	29	380	−20.8	40				
9,000	31	327	−31.3	46	30	333	−26.5	48	28	328	−28.9	45	31	327	−32.2	33	30	332	−27.2	42	29	331	−28.0	40				
10,000	31	284	−38.8		30	290	−34.0	48	28	285	−36.5		31	283	−39.4	33	30	289	−34.5	41	29	288	−35.4	38				
11,000	31	245	−46.1		29	250	−42.0		28	246	−44.2		31	244	−45.8		30	250	−42.2		29	249	−43.0					
12,000	31	210	−52.3		29	215	−49.9		26	212	−51.4		31	210	−50.9		30	215	−50.0		29	214	−50.7					
13,000	30	180	−56.4		27	184	−57.5		26	181	−57.8		31	180	−53.6		30	184	−57.6		29	183	−57.6					
14,000	30	153	−59.4		26	157	−63.8		23	155	−62.0		31	154	−55.6		29	156	−64.2		28	156	−63.0					
15,000	30	130	−62.0		26	133	−68.8		21	133	−63.4		30	132	−58.0		28	133	−68.8		24	132	−66.0					
16,000	29	111	−62.9		22	112	−71.0		16	114	−63.1		29	112	−59.3		28	112	−69.1		22	112	−67.2					
17,000	26	94	−62.6		19	95	−71.5		12	96	−62.2		27	96	−59.8		26	95	−68.4		19	95	−66.9					
18,000	19	80	−60.8		17	80	−69.6		10	82	−61.2		27	82	−58.9		24	80	−67.1		14	80	−64.6					
19,000	11	68	−58.6		16	68	−66.6		5	69	−59.8		23	70	−57.5		24	68	−64.5		8	68	−62.6					
20,000					7	58	−63.3						16	59	−55.8		11	58	−61.4									
21,000													10	50	−53.9													

Footnote at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1942*—Continued

Altitude (meters) m. s. l.	Oakland, Calif. (2 m.)				Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)				Pensacola, Fla.[1] (24 m.)				Phoenix, Ariz. (339 m.)				Portland, Maine (20 m.)				St. Louis, Mo. (171 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,014	16.6	80	29	970	25.4	69	31	979	24.2	75	17	1,016	27.2	79	31	969	34.0	33	31	1,012	16.4	90	31	996	25.2	77
500	31	958	17.3	70	29	959	26.3	65	31	958	25.2	65	17	961	24.8	69	31	952	35.8	27	31	957	18.2	70	31	959	25.6	65
1,000	31	903	22.4	40	29	906	24.7	59	31	905	23.7	59	17	908	22.2	63	31	901	33.3	25	31	903	15.7	70	31	906	22.4	65
1,500	31	853	21.4	31	29	855	21.4	61	31	854	21.3	56	16	857	19.2	58	31	852	29.8	25	31	851	12.6	75	31	855	19.4	65
2,000	31	804	19.1	27	29	807	18.3	60	31	805	18.4	51	16	808	16.2	53	31	805	25.8	27	31	802	9.5	75	31	806	16.2	63
2,500	31	758	16.4	26	29	761	15.0	57	30	760	15.2	49	16	762	13.1	51	30	760	21.5	30	31	754	6.9	66	31	760	13.1	56
3,000	31	715	13.3	25	29	717	12.0	53	30	716	11.9	48	16	718	10.2	50	30	717	17.6	32	30	710	4.4	56	31	716	10.2	52
4,000	31	634	6.4	25	29	636	5.8	48	30	634	4.8	50	16	636	4.4	48	30	637	9.3	38	29	627	−.3	47	31	635	4.2	53
5,000	31	560	−.5	25	29	562	−.3	45	29	560	−2.1	50	15	562	−1.4	49	30	564	1.7	47	26	553	−6.4	40	30	561	−1.9	52
6,000	31	494	−7.6	25	29	496	−6.6	39	28	494	−8.5	45	13	496	−7.4	51	30	498	−5.5	52	25	486	−12.8	37	29	494	−7.9	47
7,000	31	433	−14.9	24	28	436	−13.1	37	28	434	−15.1	41	11	436	−13.3	50	30	438	−11.8	48	25	426	−19.4	37	29	434	−14.4	42
8,000	31	379	−22.4	24	28	381	−20.4	37	28	379	−22.5	37	7	380	−20.0	----	30	383	−18.4	44	25	371	−26.1	34	29	379	−21.4	40
9,000	31	330	−30.0	24	28	332	−27.8	36	27	329	−29.8	36	7	331	−27.1	----	30	334	−25.5	44	24	322	−33.5	35	29	330	−28.7	38
10,000	29	286	−37.5	24	28	288	−35.5	36	27	286	−37.5	36	6	289	−34.4	----	30	291	−33.0	43	24	279	−40.9	----	29	286	−36.5	36
11,000	29	247	−44.4	----	28	249	−43.2	----	26	247	−45.1	----	5	250	−42.1	----	29	252	−40.6	----	21	240	−47.0	----	29	247	−44.4	----
12,000	29	212	−50.7	----	28	214	−50.3	----	26	212	−51.7	----	5	216	−50.6	----	29	217	−48.4	----	18	207	−50.7	----	29	213	−51.0	----
13,000	29	182	−56.1	----	27	184	−56.4	----	25	181	−55.9	----	----	----	----	----	29	186	−55.7	----	17	176	−54.1	----	27	182	−55.8	----
14,000	28	155	−60.7	----	26	156	−61.9	----	25	155	−58.7	----	----	----	----	----	29	159	−62.6	----	14	151	−55.1	----	24	155	−59.6	----
15,000	28	132	−64.1	----	26	133	−65.6	----	24	132	−61.6	----	----	----	----	----	29	135	−67.9	----	11	128	−55.5	----	24	132	−61.9	----
16,000	24	112	−65.4	----	25	112	−68.0	----	24	112	−63.2	----	----	----	----	----	29	114	−70.0	----	10	110	−55.6	----	22	113	−63.9	----
17,000	23	95	−64.9	----	1	95	−68.7	----	20	95	−62.4	----	----	----	----	----	28	96	−69.8	----	8	94	−54.5	----	16	95	−63.0	----
18,000	14	80	−63.6	----	16	80	−67.1	----	18	81	−60.5	----	----	----	----	----	27	82	−67.8	----	5	79	−52.5	----	13	81	−60.7	----
19,000	7	69	−61.3	----	11	69	−64.6	----	16	68	−58.1	----	----	----	----	----	23	69	−64.8	----	----	----	----	----	11	69	−58.5	----
20,000	----	----	----	----	6	58	−61.6	----	10	58	−55.6	----	----	----	----	----	19	59	−61.6	----	----	----	----	----	9	58	−56.2	----
21,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	10	50	−59.0	----	----	----	----	----	6	50	−54.0	----
22,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	6	43	−57.0	----	----	----	----	----	----	----	----	----

Altitude (meters) m. s. l.	St. Paul, Minn. (225 m.)				San Antonio, Tex. (242 m.)				San Diego, Calif.[1] (19 m.)				S. S. Marie, Mich. (221 m.)				Seattle, Wash.[1] (27 m.)				Spokane, Wash. (598 m.)				Washington D. C. (25 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	988	20.7	78	31	992	25.6	80	30	1,010	18.7	84	31	988	14.9	86	31	1,014	20.5	70	31	944	23.2	48	30	1,013	24.2	77
500	30	957	20.6	71	31	961	24.8	78	30	957	21.0	61	31	957	16.6	72	31	960	18.3	66	----	----	----	----	30	959	23.7	65
1,000	30	903	17.9	68	31	908	22.3	75	30	904	24.9	29	31	902	14.9	65	31	905	15.3	62	31	901	22.2	46	30	906	20.6	65
1,500	30	852	15.1	66	31	857	19.7	72	30	853	24.4	24	31	850	11.6	68	31	853	12.8	60	31	851	18.6	48	30	855	17.2	72
2,000	30	803	12.7	60	31	808	17.1	66	30	806	22.0	24	31	800	8.7	69	31	803	9.8	54	31	802	14.7	50	30	806	13.9	77
2,500	30	756	10.2	55	31	762	14.6	57	30	759	18.6	26	31	753	6.7	62	31	756	6.8	51	31	755	10.7	54	30	759	10.8	76
3,000	30	712	7.3	55	31	718	11.8	54	30	716	14.9	29	31	708	3.9	58	31	711	3.4	49	31	711	6.8	58	30	715	8.1	67
4,000	30	630	2.0	52	31	637	6.1	53	30	635	7.3	34	31	626	−1.6	49	31	628	−2.6	39	31	629	.3	59	29	633	3.3	58
5,000	30	556	−3.9	50	31	563	.6	52	29	561	−.3	40	29	551	−7.4	42	31	553	−9.4	40	31	555	−6.0	56	29	559	−1.9	54
6,000	30	489	−10.7	49	31	496	−5.4	48	28	495	−6.6	39	27	484	−14.0	40	31	485	−16.3	42	31	487	−12.9	51	29	493	−7.7	51
7,000	30	429	−17.6	47	31	436	−11.9	46	28	435	−13.2	27	26	424	−20.8	37	30	424	−23.4	43	28	427	−20.2	50	27	433	−13.9	46
8,000	30	374	−24.7	44	31	382	−18.9	46	13	381	−20.6	----	24	368	−28.4	34	28	368	−31.1	45	28	372	−27.5	48	24	378	−20.7	45
9,000	29	325	−32.0	41	31	333	−26.2	45	13	332	−27.8	----	21	320	−35.4	28	28	319	−38.2	52	28	322	−35.2	47	24	329	−28.0	46
10,000	29	282	−39.4	40	31	290	−33.7	43	12	289	−35.2	----	20	277	−41.7	----	27	276	−45.4	----	28	279	−42.9	----	19	286	−35.6	43
11,000	29	243	−46.1	----	30	250	−41.5	----	12	250	−42.6	----	18	239	−46.2	----	27	236	−51.6	----	27	240	−49.3	----	15	248	−43.4	----
12,000	27	209	−51.5	----	30	216	−49.3	----	11	216	−50.3	----	17	205	−48.0	----	24	202	−54.3	----	26	206	−52.0	----	13	212	−51.7	----
13,000	25	179	−54.5	----	29	185	−56.6	----	7	184	−57.5	----	16	176	−48.5	----	23	173	−54.4	----	26	176	−52.7	----	10	182	−58.4	----
14,000	23	153	−56.2	----	26	158	−62.8	----	7	157	−64.2	----	15	151	−49.9	----	18	148	−55.1	----	26	151	−53.5	----	8	155	−62.7	----
15,000	21	131	−58.1	----	26	134	−67.4	----	----	----	----	----	13	130	−51.6	----	17	126	−56.3	----	24	129	−55.0	----	6	132	−64.9	----
16,000	21	112	−58.9	----	25	113	−70.4	----	----	----	----	----	9	112	−52.2	----	11	108	−57.1	----	21	111	−56.2	----	6	112	−65.5	----
17,000	19	95	−58.4	----	21	96	−70.6	----	----	----	----	----	----	----	----	----	8	91	−56.9	----	16	94	−56.9	----	----	----	----	----
18,000	10	81	−57.2	----	18	81	−68.2	----	----	----	----	----	----	----	----	----	5	78	−56.3	----	11	81	−56.8	----	----	----	----	----
19,000	6	69	−54.8	----	10	69	−65.5	----	----	----	----	----	----	----	----	----	----	----	----	----	8	69	−56.2	----	----	----	----	----
20,000	5	59	−52.8	----	6	58	−61.7	----	----	----	----	----	----	----	----	----	----	----	----	----	6	59	−54.9	----	----	----	----	----

Footnote at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1942*—Continued

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level																			
	Anchorage, Alaska (42 m.)				Barrow, Alaska (6 m.)				Bethel, Alaska (7 m.)				Juneau, Alaska (49 m.)				Ketchikan, Alaska (26 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,011	16.7	67	31	1,011	6.1	87	31	1,013	15.4	70	31	1,011	16.6	70	31	1,014	18.7	63
500	31	957	13.3	71	31	952	7.1	77	31	955	11.4	75	31	959	13.8	71	31	959	14.9	69
1,000	31	902	10.0	77	31	896	5.8	75	31	900	7.9	81	31	904	10.3	78	31	904	11.1	75
1,500	31	849	6.7	83	31	842	3.4	77	31	847	5.2	85	31	851	7.1	81	31	852	7.9	81
2,000	31	798	3.6	87	31	791	1.3	75	31	796	3.1	81	31	800	4.2	83	31	801	5.5	76
2,500	31	751	1.1	86	31	744	−.8	74	31	748	1.3	75	30	753	1.7	81	31	753	2.8	73
3,000	30	705	−1.4	83	31	698	−3.2	69	30	703	−.8	67	30	707	−.8	77	31	708	.1	69
4,000	30	622	−6.7	73	29	615	−8.3	64	29	620	−5.4	60	27	624	−5.9	66	31	625	−5.1	63
5,000	30	546	−12.6	67	29	540	−14.4	62	29	545	−11.3	54	26	548	−12.0	61	31	549	−11.4	59
6,000	30	479	−19.5	63	28	472	−20.9	59	29	478	−17.9	49	26	480	−18.9	61	27	481	−18.3	59
7,000	30	418	−26.6	60	28	412	−27.8	58	29	417	−24.8	47	25	419	−26.0	61	26	420	−25.2	59
8,000	29	363	−34.1	57	28	358	−35.2	57	29	363	−31.6	45	25	364	−33.7	60	25	366	−32.6	57
9,000	28	314	−41.3		28	309	−42.3		28	314	−38.7	45	24	315	−41.4		25	316	−39.9	57
10,000	28	270	−47.5		28	266	−46.9		28	271	−45.1		24	272	−47.8		24	273	−46.1	
11,000	28	232	−49.3		27	229	−47.8		28	233	−48.8		24	233	−51.0		24	235	−50.2	
12,000	28	200	−48.3		27	197	−46.1		28	200	−48.8		24	200	−50.4		22	201	−50.9	
13,000	27	171	−47.6		26	170	−44.5		28	172	−48.1		24	172	−49.5		20	172	−49.4	
14,000	27	147	−47.6		21	146	−44.5		28	148	−47.9		24	147	−49.1		17	149	−48.8	
15,000	24	126	−47.8		20	126	−44.7		27	127	−47.9		23	126	−49.1		16	127	−49.2	
16,000	23	109	−47.9		17	109	−44.4		27	109	−48.0		21	109	−49.1		15	110	−49.4	
17,000	23	94	−47.8		14	94	−43.9		27	94	−47.8		21	93	−48.7		12	94	−49.6	
18,000	20	81	−47.3		9	80	−42.7		26	80	−47.3		18	80	−48.2		8	81	−49.3	
19,000	18	70	−46.6		6	69	−42.0		20	69	−46.7		18	69	−47.7		6	70	−48.7	
20,000	12	60	−45.8						14	59	−46.0		13	59	−47.2					
21,000	10	52	−45.2						7	51	−45.4		7	51	−46.8					

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level															
	McGrath, Alaska (100 m.)				Nome, Alaska (14 m.)				San Juan, P. R. (15 m.)				Swan Island, W. I. (10 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of obersvations	Pressure	Temperature	Relative humidity
Surface	30	1000	17.8	59	29	1010	10.6	84	31	1016	26.2	86	31	1014	27.0	85
500	30	954	14.4	61	29	953	8.7	84	31	962	23.5	89	31	960	23.2	89
1,000	30	899	10.4	68	29	897	6.6	84	31	909	20.5	88	31	906	20.2	85
1,500	30	846	6.8	75	29	844	4.5	85	31	858	17.7	83	31	855	17.6	77
2,000	30	796	3.5	80	29	793	2.6	82	31	808	15.3	73	31	806	14.9	71
2,500	30	748	.6	85	29	745	.5	75	31	762	13.4	63	31	760	12.5	65
3,000	30	703	−1.9	84	29	700	−1.6	70	31	718	11.0	56	31	716	9.8	60
4,000	30	619	−7.0	74	29	617	−6.7	65	29	637	5.0	52	31	634	4.1	57
5,000	30	544	−12.8	62	28	542	−12.9	60	28	563	−.7	51	30	560	−1.6	57
6,000	30	476	−19.4	56	28	475	−19.7	56	28	496	−6.2	48	29	493	−7.6	56
7,000	30	416	−26.4	53	28	414	−26.8	53	28	436	−11.9	46	27	433	−13.9	55
8,000	30	361	−33.3	52	28	359	−33.3	51	28	382	−18.6	41	24	379	−20.5	53
9,000	30	312	−40.4		25	311	−39.3	50	28	333	−25.9	40	24	330	−27.6	52
10,000	29	270	−45.9		25	268	−43.3		28	290	−33.3	39	24	287	−35.5	
11,000	29	232	−47.4		24	232	−45.8		27	251	−41.3		23	248	−43.9	
12,000	29	199	−47.4		23	199	−46.1		27	216	−49.4		17	213	−52.7	
13,000	29	171	−46.5		23	171	−45.2		24	185	−57.1		13	182	−61.6	
14,000	29	147	−46.5		22	147	−45.1		24	158	−63.7		12	154	−70.8	
15,000	28	126	−46.9		22	127	−45.1		23	134	−68.6		10	130	−79.4	
16,000	28	109	−46.9		20	109	−44.9		23	113	−71.7		10	109	−83.0	
17,000	27	94	−46.7		18	94	−44.6		21	95	−74.1		10	91	−84.0	
18,000	24	81	−46.1		16	81	−44.1		19	80	−72.7		6	76	−79.9	
19,000	22	70	−45.5		7	70	−43.1		16	68	−69.7		5	64	−75.0	
20,000	15	60	−45.0						10	57	−65.8					
21,000	12	52	−44.6													

All observations taken at 11 p. m., 75th meridian time.

None of the means included in this table are based on less than 15 surface or 5 standard level observations.

Number of observations refers to pressure only, as temperature and humidity are missing for some observations at certain levels, also, the humidity data are not used in daily observations when the temperature is below −40° C.

Stations marked with the superior figure one [1] are Navy stations.

LATE REPORTS FOR JUNE 1942

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during June 1942*

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level											
	Pearl Harbor, T. H. (12 m.)				San Juan, P. R. (15 m.)				Swan Island, W.I. (10 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	29	1016	24.5	72	26	1014	25.8	87	30	1011	27.2	85
500	29	960	20.9	71	26	961	23.3	88	30	957	23.9	88
1,000	29	906	17.3	74	26	907	20.3	88	30	904	21.0	82
1,500	29	855	14.6	70	26	856	17.3	86	30	853	18.4	77
2,000	29	805	12.7	58	26	807	14.9	80	30	804	15.9	72
2,500	29	758	10.7	45	26	760	12.3	74	30	758	13.5	66
3,000	29	714	8.8	36	26	716	9.6	68	30	714	10.9	61
4,000	29	632	3.4	24	26	634	4.0	68	28	633	4.9	62
5,000	29	558	−2.2	26	25	561	−1.3	71	28	559	−1.1	64
6,000	29	491	−8.7	----	25	495	−6.9	66	28	493	−7.0	59
7,000	28	431	−15.6	----	24	435	−13.1	64	27	433	−13.1	56
8,000	----	----	----	----	24	381	−19.8	63	27	380	−19.5	54
9,000	----	----	----	----	24	331	−26.9	62	27	331	−26.6	53
10,000	----	----	----	----	24	288	−34.4	60	27	288	−34.6	----
11,000	----	----	----	----	24	249	−42.3	----	25	249	−43.0	----
12,000	----	----	----	----	24	215	−50.4	----	15	214	−51.4	----
13,000	----	----	----	----	24	183	−58.2	----	8	183	−60.3	----
14,000	----	----	----	----	24	156	−65.2	----	5	155	−70.1	----
15,000	----	----	----	----	23	133	−70.9	----	----	----	----	----
16,000	----	----	----	----	22	112	−75.0	----	----	----	----	----
17,000	----	----	----	----	22	94	−75.8	----	----	----	----	----
18,000	----	----	----	----	21	79	−73.8	----	----	----	----	----
19,000	----	----	----	----	18	67	−69.2	----	----	----	----	----
20,000	----	----	----	----	16	57	−65.0	----	----	----	----	----
21,000	----	----	----	----	9	48	−61.4	----	----	----	----	----

LATE REPORTS FOR MAY 1942

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during May 1942*

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level											
	Bethel, Alaska (7 m.)				Pearl Harbor, T. H.[1] (12 m.)				Swan Island, W. I. (10 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,010	10.2	58	31	1,015	24.0	71	31	1,011	26.3	84
500	31	952	6.2	61	31	960	20.4	71	31	956	23.1	89
1,000	31	895	2.7	63	31	906	16.9	72	31	903	20.1	84
1,500	31	841	−.5	67	31	854	14.0	70	31	852	17.3	79
2,000	31	790	−3.3	71	31	805	12.5	58	31	803	14.6	75
2,500	31	741	−5.9	70	31	758	10.3	44	31	757	12.0	72
3,000	31	695	−8.1	64	31	714	8.4	30	31	712	9.3	67
4,000	31	610	−13.7	60	31	631	3.4	21	31	631	4.0	64
5,000	31	534	−19.7	56	31	557	−2.9	22	31	558	−0.8	62
6,000	31	467	−26.0	54	31	490	−9.7	34	31	492	−6.1	54
7,000	31	405	−32.8	53	30	430	−16.5	42	30	432	−12.4	48
8,000	31	351	−40.2	51	----	----	----	----	30	379	−19.5	46
9,000	31	302	−46.0	----	----	----	----	----	30	330	−26.6	43
10,000	31	260	−50.3	----	----	----	----	----	29	287	−34.3	----
11,000	30	223	−52.0	----	----	----	----	----	29	248	−42.5	----
12,000	29	191	−50.7	----	----	----	----	----	26	214	−50.7	----
13,000	29	164	−49.9	----	----	----	----	----	23	183	−59.6	----
14,000	26	141	−49.1	----	----	----	----	----	20	156	−69.0	----
15,000	26	120	−48.6	----	----	----	----	----	18	131	−78.4	----
16,000	24	104	−48.5	----	----	----	----	----	17	110	−87.0	----
17,000	23	89	−48.5	----	----	----	----	----	16	91	−90.5	----
18,000	17	76	−48.4	----	----	----	----	----	13	76	−86.8	----
19,000	12	66	−48.1	----	----	----	----	----	9	63	−81.9	----
20,000	----	----	----	----	----	----	----	----	5	53	−75.8	----

Station marked with the superior figure one [1] is Navy station.

LATE REPORT FOR JULY 1941

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1941*

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level			
	Joliet, Ill. (178 m.)			
	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	994	19.4	82
500	30	957	21.9	73
1,000	30	904	20.7	67
1,500	30	853	17.4	67
2,000	30	804	14.4	63
2,500	30	758	11.4	59
3,000	30	713	8.8	54
4,000	30	632	3.2	51
5,000	28	558	−3.1	48
6,000	28	491	−9.2	42
7,000	28	431	−15.5	41
8,000	27	376	−22.6	40
9,000	27	328	−29.8	40
10,000	27	284	−37.4	38
11,000	26	245	−44.8	----
12,000	26	211	−51.6	----
13,000	26	181	−55.8	----
14,000	26	154	−58.7	----
15,000	24	132	−60.0	----
16,000	23	112	−60.0	----
17,000	20	96	−59.3	----
18,000	17	82	−58.7	----
19,000	6	70	−56.8	----

LATE REPORT FOR JUNE 1941

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during June 1941*

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level			
	Joliet, Ill. (178 m.)			
	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	993	17.5	83
500	30	956	19.3	70
1,000	30	902	17.6	63
1,500	30	851	14.6	68
2,000	30	801	11.4	74
2,500	30	755	8.4	82
3,000	30	710	5.8	65
4,000	30	628	0.6	58
5,000	30	554	−5.0	52
6,000	30	487	−11.3	50
7,000	30	427	−18.3	47
8,000	29	372	−25.4	44
9,000	29	323	−32.9	44
10,000	29	280	−40.7	----
11,000	28	241	−47.7	----
12,000	28	207	−52.9	----
13,000	26	177	−56.9	----
14,000	25	151	−58.9	----
15,000	24	129	−58.9	----
16,000	19	110	−58.9	----
17,000	16	93	−59.1	----
18,000	12	79	−58.3	----
19,000	6	67	−56.8	----

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during July 1942. Directions given in degrees from North (N=360°, E=90, S=180°, W=270°)—Velocities in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (538 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (866 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m.)			Charleston, S. C. (17 m.)			Cincinnati, Ohio (152 m.)			Denver, Colo. (1,627 m.)			El Paso, Tex. (1,196 m)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	160	4.3	31	245	1.1	31	271	2.6	31	71	1.4	31	220	0.9	31	326	4.0	31	122	5.8	31	243	3.7	30	231	0.9	31	211	2.2	31	249	1.6	31	60	1.5	31	138	1.6
500							31	269	3.1										31	132	6.8	31	252	5.3	30	236	2.4	31	222	3.8	31	254	3.5						
1,000	31	161	4.8				31	272	3.8				31	309	1.0	31	325	3.8	29	141	5.5	31	259	6.2	30	254	3.1	31	250	4.0	31	258	4.6						
1,500	31	165	4.8				31	284	3.7	31	49	0.7	30	296	2.0	31	316	2.9	29	141	4.9	26	261	7.2	29	268	4.6	30	268	5.1	30	273	5.6				31	139	2.4
2,000	30	173	4.4	31	250	1.5	30	289	4.1	31	286	0.6	27	284	4.9	31	288	2.8	26	144	3.4	26	268	8.4	26	267	6.5	26	276	5.1	27	285	6.0	31	51	1.4	31	135	1.9
2,500	29	183	3.8	31	231	1.1	26	290	4.5	31	284	2.9	25	291	6.0	31	268	5.1	26	146	4.4	22	266	9.0	19	273	7.5	26	279	5.2	24	293	6.7	31	44	1.6	31	118	1.3
3,000	29	199	3.0	31	277	1.0	25	292	4.9	30	278	5.7	20	278	7.9	31	249	7.0	23	138	4.3	14	279	9.8				22	284	4.5	21	297	7.2	30	29	1.6	31	72	1.4
4,000	20	269	1.1	29	310	2.3	23	288	4.3	28	265	10.8	16	285	12.9	30	244	9.9	21	143	4.3	11	294	14.4				19	274	4.6	14	291	9.4	28	299	2.9	30	57	3.6
5,000	17	24	1.4	27	323	3.4	18	278	4.9	28	271	14.5	13	295	14.8	28	242	12.2	20	140	3.6							17	271	2.6	10	287	10.4	25	289	6.6	27	55	2.8
6,000	14	28	1.0	24	311	2.5	14	278	6.1	25	272	16.1	10	285	15.9	26	246	13.0	18	124	3.8							15	260	3.2				20	293	8.7	22	42	3.5
8,000	13	18	0.9	18	322	4.3	11	256	7.4	20	271	18.3				24	248	16.8	12	107	2.5							13	255	1.6				14	309	10.1	17	53	4.4
10,000	11	162	3.4	13	301	5.4				12	278	22.5				14	264	20.2																11	295	9.5	15	43	4.4
12,000	11	180	3.7																															10	301	13.3	15	35	4.6
14,000	10	138	8.9																																				

Altitude (meters) m. s. l.	Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (16 m.)			Joliet, Ill. (178 m.)			Las Vegas, Nev. (570 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (410 m.)			Miami, Fla. (10 m.)[1]			Mobile, Ala. (66 m.)			Nashville, Tenn. (194 m.)			New York, N. Y. (15 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	209	4.1	31	321	1.7	30	246	1.2	29	307	2.5	29	145	1.8	31	252	2.2	31	184	3.1	30	208	2.0	31	311	2.9	31	101	3.7	31	203	1.9	31	269	1.4	27	307	1.6
500							30	250	2.2				29	204	2.9	31	248	2.6				30	208	3.0	31	307	3.4	31	105	4.9	31	215	3.2	31	253	2.0	27	250	3.2
1,000							30	248	3.2	29	295	3.5	27	228	3.4	31	246	4.2	31	189	5.6	30	215	3.2	31	303	2.5	30	99	4.0	31	236	2.1	31	266	2.5	27	274	4.7
1,500							28	272	3.5	28	281	4.1	27	258	3.5	31	253	6.1	31	200	5.0	30	236	3.1	31	271	1.6	29	85	3.9	31	269	2.2	30	277	3.0	26	289	5.9
2,000	31	213	3.9	31	309	3.0	28	282	4.7	28	266	5.8	26	271	4.2	29	262	7.4	31	205	5.8	27	257	3.4	31	227	3.2	29	88	3.7	28	270	2.6	29	280	3.6	21	291	7.0
2,500	31	216	4.5	31	305	3.1	25	293	5.9	27	269	7.4	26	273	4.1	24	280	8.6	31	212	5.0	24	260	3.8	31	206	4.6	28	90	3.5	24	255	2.6	28	278	5.1	18	301	7.1
3,000	31	216	4.5	31	289	3.2	22	301	6.9	26	270	9.8	25	269	4.2	22	286	10.3	31	218	5.4	21	265	4.4	31	209	6.0	27	92	3.7	19	259	1.9	24	276	5.2	12	288	7.0
4,000	31	230	5.6	29	274	4.2	21	292	7.2	20	273	12.8	22	252	3.7	11	291	12.0	31	224	6.2	14	269	4.3	29	222	9.2	23	106	3.0	14	277	2.4	19	287	5.3			
5,000	26	228	7.2	29	274	5.7	20	295	7.9	17	274	14.6	18	248	2.1				30	226	5.5				28	228	10.1	22	102	3.2				15	300	5.1			
6,000	22	229	8.6	27	270	5.6	19	284	8.0	13	267	15.0	13	212	1.8				27	224	6.4				26	231	11.0	21	106	3.1				10	282	7.1			
8,000	13	244	10.6	15	282	6.2	15	277	10.1				10	142	2.2				24	248	8.4				26	236	14.7	17	100	5.1									
10,000							11	282	7.3										24	258	12.4				26	240	19.6	12	94	4.2									
12,000																			21	257	13.9				17	242	24.3												
14,000																			19	253	8.7				13	248	18.7												
16,000																			15	209	4.9																		

Altitude (meters) m. s. l.	Oakland Calif. (8 m.)			Oklahoma City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Louis, Mo. (181 m.)			St. Paul, Minn. (225 m.)			San Antonio, (240 m.)[2]			San Diego, Calif. (15 m.)			Sault St. Marie, Mich. (230 m.)			Seattle, Wash. (12 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	280	5.9	31	180	6.2	31	171	1.9	31	277	1.6	31	41	1.5	31	226	2.5	31	238	1.4	29	139	3.2	30	275	3.7	31	288	3.1	30	255	1.3	31	227	1.1	31	241	1.3
500	31	270	3.7	31	180	6.3	31	170	2.8	31	266	2.6				31	226	3.0	31	249	1.7	29	136	4.4	30	280	2.6	31	292	4.5	30	224	2.9				31	257	2.7
1,000	31	267	3.8	31	192	6.2	31	198	3.7	31	263	2.9	31	39	1.5	30	242	3.7	30	249	3.4	28	145	3.6	30	304	2.0	31	279	5.6	28	219	3.1	31	216	2.0	30	280	3.9
1,500	31	265	3.7	31	203	6.1	31	226	4.7	31	256	3.3	31	17	1.5	29	255	5.0	26	265	5.5	27	153	4.0	30	302	1.1	25	273	6.9	26	211	2.4	31	227	2.2	30	284	5.8
2,000	31	240	3.8	31	208	4.8	29	250	6.0	31	259	2.7	31	306	1.7	28	262	6.2	25	276	6.8	26	153	4.0	30	218	1.5	20	289	8.4	23	205	2.6	30	223	3.9	26	293	8.2
2,500	31	227	4.9	30	226	4.1	27	263	6.1	31	264	1.7	30	291	4.0	26	269	6.4	16	299	7.6	25	158	3.5	29	188	3.4	16	286	8.7	21	202	2.3	30	229	5.2	25	292	9.5
3,000	30	222	5.5	28	235	3.5	27	273	7.1	31	292	.8	28	289	6.4	25	269	7.0	10	291	11.1	23	161	3.2	28	188	4.7	10	297	10.4	19	209	2.4	27	236	6.4	22	284	10.7
4,000	29	213	7.8	23	256	2.0	25	285	8.7	31	59	.3	21	283	10.1	21	285	6.6				20	98	1.0	25	185	6.4				17	227	3.5	22	249	9.5	18	287	10.6
5,000	28	202	8.2	19	312	2.1	21	294	9.7	30	135	2.1	18	281	12.3	18	288	7.0				17	28	.2	24	185	6.6				16	245	6.6	19	246	11.0	14	288	12.4
6,000	28	211	8.7	19	311	3.0	20	284	11.4	28	106	1.8	17	288	13.3	16	291	8.3				14	312	1.3	22	192	5.1				15	229	8.4	17	244	13.5	12	282	14.0
8,000	25	219	10.3	14	278	2.3	15	284	13.0	25	38	0.9	13	277	18.9	11	266	8.7													10	241	10.5	16	252	18.8			
10,000	22	228	14.1	12	122	0.6	13	268	13.7	24	299	3.0																						13	252	23.3			
12,000	18	234	18.3	10	255	2.7				23	295	7.1																											
14,000	15	242	19.9							21	300	7.7																											
16,000	12	236	14.1							14	241	.9																											

[1] Elevation, Miami changed from 10 to 15 m. July 31.
[2] Elevation, San Antonio changed from 180 to 240 m. July 14.

TABLE 3.—*Maximum free-air wind velocities, (m.p.s.), for different sections of the United States based on pilot-balloon observations during July 1942*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station
Northeast [1]	28.2	W	1,360	6	Philadelphia, Pa.	36.4	WNW	4,270	14	Syracuse, N. Y.	68.8	NW	12,380	17	Caribou, Maine.
East-Central [2]	28.9	W	1,680	6	Cincinnati, Ohio.	27.3	WSW	2,750	6	Washington, D. C.	38.6	SW	9,570	23	Knoxville, Tenn.
Southeast [3]	30.0	WSW	2,090	6	Charleston, S. C.	24.4	W	4,480	7	Spartanburg, S. C.	30.3	NE	9,830	14	Tallahassee, Fla.
North-Central [4]	30.9	WSW	2,150	12	Duluth, Minn.	44.5	WNW	4,270	7	Milwaukee, Wis.	46.5	NNW	9,460	9	Alpena, Mich.
Central [5]	30.0	WSW	1,420	9	Wichita, Kans.	30.9	NW	4,600	7	Moline, Ill.	38.4	NW	6,150	6	Des Moines, Iowa.
South-Central [6]	31.6	SE	1,660	29	Del Rio, Tex.	24.0 24.0	WNW WSW	3,000 4,430	9 3	Tulsa, Okla. New Orleans, La.	55.0	NE	19,730	31	Little Rock, Ark.
Northwest [7]	41.2	WSW	2,310	14	Butte, Mont.	42.0	W	3,920	11	Havre, Mont.	65.0	WSW	10,660	31	Billings, Mont.
West-Central [8]	27.0	SW	2,420	12	Casper, Wyo.	38.0	SW	5,000	11	Modena, Utah.	60.8	SW	12,170	30	Winnemucca, Nev.
Southwest [9]	24.9	ESE	2,310	22	Tucson, Ariz.	37.0	NNW	4,350	24	El Paso, Tex.	39.0	SW	10,140	29	Bakersfield, Calif.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

RIVER STAGES AND FLOODS

By Bennett Swenson

The month was characterized by an uneven geographic distribution of rainfall. Excessive local rains occurred in many areas including parts of Texas, Minnesota, Iowa, northern Wisconsin, southwestern Illinois, Missouri, Pennsylvania, New York, and eastern Kentucky. These rains resulted in numerous localized but damaging floods. The highest stages of record were established in some cases notably in the upper Allegheny River Basin where phenomenal rates of rainfall occurred on July 17–18.

While parts of the Ohio Valley, the Northeastern States, the upper Mississippi Valley, southeastern Texas, and the far Northwest had above normal precipitation, most of the remainder of the country had a decidedly dry month.

Hudson Bay drainage.—A minor flood occurred in the Red River of the North from the 7th to the 12th of June. A stage of 6.4 feet was reached at Wahpeton, N. Dak. (flood stage 6 feet), on June 8 and a stage of 17.7 feet at Fargo, N. Dak. (flood stage 17 feet), on June 11. The flood was caused by locally heavy rains on the morning of June 5, followed by lighter amounts during the next 48 hours and heavy amounts again on the morning of the 8th; on the morning of the 5th, 2.76 inches of rain was recorded at Mobridge, S. Dak., and 2.15 inches at Oaks, N. Dak. (both 24-hour amounts). On the morning of the 8th, Ashley, N. Dak., reported 1.95 inches.

Light overflows took place in Moorhead, Minn., and Fargo, N. Dak., but the damage was slight.

Atlantic Slope drainage and Ohio River Basin.—On July 17–18, thunderstorms with excessive precipitation over the north-central counties of Pennsylvania and bordering counties of New York caused disastrous flooding in the upper Allegheny River Basin, and in the Sinnemahoning Creek Valley, a tributary of the West Branch of the Susquehanna River.

The flood damage area covered about 2,000 square miles in the headwaters of the Allegheny, and in the Clarion River and the Sinnemahoning Creek, in parts of Allegheny and Cattaraugus Counties in New York, and in Cameron, Elk, McKean, and Potter Counties in Pennsylvania. The following is a brief outline of the flood conditions in representative towns in the area most seriously affected:

Ridgway, Pa.—Most of the principal industries and about 10 percent of the residential section were flooded by the Clarion River and Elk Creek. The river rose 66 inches in 1⅞ hours and was above flood stage from 9:30 p. m. of the 18th to late night of the 19th. This flood was the maximum of record and was 26 inches higher than the flood of March 17, 1936.

Johnsonburg, Pa.—About 25 percent of the business section and 10 percent of the residential section were flooded. One life was lost. The flood waters rose so rapidly that the primary concern in the flood zone was evacuation so that little property was salvaged.

Flooding at this point is caused by the east and west branches of the Clarion River. The crest was 7.5 feet above the flood of March 17, 1936, and is the maximum of record. The river was out of its banks for about 12 to 18 hours.

Emporium, Pa.—The town was partially protected by dikes which had been erected following the 1936 flood, and it was not until the dikes were overtopped that the main part of the town was flooded. Most of the residents, north of the railroad tracks, did not remove their portable belongings before the dikes were overtopped and, therefore, were unable to save much of their property. This was the first time that the main business section of the town had been flooded. About 60 percent of the town was flooded. Three lives were lost.

Flooding at this point was caused by Sinnemahoning Creek. The creek was out of its banks for about 24 hours. This flood was about 34 inches higher than the flood of March 17, 1936, and about equal to the flood of June 1889.

Austin, Pa.—The principal industries and the business section and 80 percent of the residential area were flooded. The major damage was caused by failure of an earth dam 2 miles above the town. The water was about 4 to 5 feet deep on the main street.

Coudersport, Pa.—About 50 percent of the business and 25 percent of the residential sections were inundated. Flooding was caused by the overflowing of the Allegheny River. The river was out of bank about 18 hours. This is the maximum flood of record.

Port Allegany, Pa.—Six lives were lost. All major industrial plants, the entire business district, and about 50 percent of the residential areas were flooded. Fire also destroyed one home and a silk mill.

This town probably received the greatest damage per capita of any in the flood zone. The flood waters rose so rapidly that the only concern was to evacuate the people and very few portable goods were removed above the flood level. Flooding at this point was caused by the overflowing of Lille Bridge Creek and in the Allegheny River. The streams were out of bank for about 24 hours and the crest was reached about 1 p. m. of the 18th.

Olean, N. Y.—The city was partially protected by a dike system and it was not until the dikes were topped that the major flooding occurred. Four lives were lost. About 10 percent of the business and 70 percent of the residential sections were inundated.

The flooding was caused by Olean Creek and the Allegheny River. The river was above the flood stage for about 36 hours. This is the maximum flood of record.

All outlying villages and towns received severe damage and the damage was also severe in all rural sections of the flood zone. Statistics on the flood losses have not been completed and unofficial reports of phenomenal rainfall intensities have not yet been fully verified. A further report on these floods will be made in a later issue of the REVIEW.

Damaging local floods also occurred in the headwaters of the Big Sandy and Kentucky Rivers in eastern Kentucky on July 8–9, with the greatest damage in Knott, Perry, Floyd, and Letcher Counties. Jackson, Ky., reported 4.77 inches of rain in 24 hours preceding the morning of the 8th.

Several small towns were completely flooded and damage to buildings and crops was heavy. Three lives were lost and property damage has been estimated at $1,500,000.

Flood stage was not reached at any station on the main channel of the Big Sandy River but two stations on the North Fork of the Kentucky River, Hazard and Jackson, Ky., exceeded flood stage. At Hazard the crest was 21.5 feet (flood stage 20 feet) and at Jackson, Ky., 32.4 feet (flood stage 28 feet), on July 9.

Flooding occurred in the headwaters of the Hocking River on June 30–July 1 from excessive rains. At Lancaster, Ohio, 3.48 inches of rain fell between 5:05 and 6:20 p. m., June 30, with an additional 0.37 inch between 5:35 and 6:45 p. m. July 1.

Great Lakes Drainage.—Exceptionally heavy rains occurred in extreme northern Wisconsin on July 16–17. Some of the rainfall amounts during this storm were as follows: Ashland, 3.01 inches; Bayfield, 8.68 inches; Big St. Germain Dam, 4.98 inches; Brule Island, 5.06 inches; Land O'Lakes, 4.84 inches and Rest Lake, 8.06 inches.

The greatest damage occurred at Bayfield, which is located on a steep hillside rising from Lake Superior. The heavy rain began at 9:30 p. m., July 16 and continued intermittently until 9:30 a. m., July 17, during which 12 hour period 8.52 inches of rain fell. The water concentrated in two ravines behind the city and swept through the center of the business district, forming gullies 50 feet wide and 20 feet deep in places. Along the lake shore, sand was filled in to a depth of 10 feet. The total damage has been estimated at $500,000.

Upper Mississippi River Basin.—Extensive flooding occurred during the months of June and July in the upper Mississippi Basin. The flooding began late in May when heavy rains fell principally over the Chippewa and Wisconsin River Basins. Frequent rains during the month of June resulted in further flooding in the tributary streams particularly in Minnesota, Iowa, and Missouri. A general rise began in the Mississippi River early in June. The flooding in the Mississippi extended from Winona, Minn., to just above its junction with the Ohio River beginning in the upper reaches on June 3 and continuing at Cape Girardeau, Mo., until July 10. Reports on these floods are submitted by the river district officials as given below.

River District of La Crosse, Wis., comprising the Mississippi River and tributaries from Hastings, Minn., to lock and dam No. 8:

SOURCE OF FLOOD

Rainfall was well distributed throughout the first 3 weeks in May. Some locally heavy thundershowers fell over the entire river district resulting in high groundwater table and preparing the soil for low initial loss for the extended and heavy rains which fell the last week in May. Widespread rains of the thunderstorm type occurred from the 25th to the 31st of May, the period which may be considered flood producing with the center of mass of rainfall on the 29th. Although subsequent light rains fell during the first week in June, and aggravated to some extent the flood conditions which followed; the average storm index was calculated as 2.40 inches over the 63,000 square miles of drainage area above La Crosse, Wis.

HYDROLOGIC FACTORS

The focal point of the rains during the period appeared in the area just east of Minneapolis and St. Paul, Minn., covering the counties of Washington in Minnesota and Pierce and St. Croix of Wisconsin. The amounts of precipitation and the approximate areas involved are as follows:

Amount of precipitation (inches):

	Areas involved (square miles)
7.00	600
6.00	2, 900
5.00	4, 000
4.00	5, 500
3.00	10, 000
2.00	15, 000
1.00	21, 800
0.50	3, 000
0.25	300

From the factor of actual flood stream-flow it appears that the surface run-off or amount of rainfall actually finding its way into the main channel was 11% of the average basin fall of 2.40 inches.

METEOROLOGICAL ANALYSIS—STORM OF MAY 25–31

On the first day of extended rainfall, a low-pressure trough appeared over the central plains with a strong inflow of maritime-tropical air from the Gulf of Mexico. Continental polar air prevailed over the eastern half of the country. On the 26th these conditions continued with a cold front extending from Sault Sainte Marie, Mich., to northern Nebraska. By the morning of the 27th warm front activity intensified over northern Nebraska, producing heavy rains over North Dakota and the extreme upper Mississippi Valley. On the 28th and 29th the area of heaviest rainfall progressed eastward with the movement of the frontal zone and occurred as a result of lifting and intense convergence of the moist tropical air in advance of, and with the passage of the front. Heavy rains fell in the Chippewa Valley at this time. The strong high pressure over the East played a major role in the retardation of fronts resulting in prolonged precipitation.

On the 30th and 31st a stationary front in the upper Mississippi Valley caused continuous but light rains to fall over most of the drainage area of this district.

COMPARISON OF FLOOD INTENSITY

Floods occurring at this time of the year are commonly termed June "rises" and are much less numerous than the spring rises or even those occurring in the fall. The June rises are invariably caused by heavy extended rains of the thunderstorm type.

The highest flood on record, occurring in June 1880, was of this type. The present flood was the second highest on record belonging to this classification. The previous high flood exceeding the present flood crest, 13.0 feet at La Crosse, Wis., on June 5, was 13.7 feet on April 17, 1922. This definitely classifies the present June flood as one of maximum intensity. The occurrence at this time of the year necessarily involves great prospective crop losses.

DAMAGE

By far the greater damage was done to agricultural interests and highways, partly due to excessive downpours of rain. Approximately 20,000 acres of land with prospective crops were affected with about one-third this area in the actual flood plain of the streams. Building losses were comparatively small, this being confined to summer homes and cottages on low ground. Some suspension of business resulted and the railroad from Wabasha, Minn., to Eau Claire, Wis., was closed for about 1 week due to track flooding. The main railroad roadbeds along the river were not affected.

Damages are listed in the following table:

1. Tangible property totally or partially destroyed, such as buildings, fences, factories, highways, bridges, railroads, etc	$626, 075
2. Agricultural losses:	
(a) Matured crops	47, 000
(b) Prospective crops involving 20,000 acres	699, 500
(c) Livestock and other movable farm equipment	15, 580
3. Suspension of business, including wages of employees	41, 700
4. Money value of property saved by flood warnings	175, 000

In addition to the main channel and tributary floods occurring the first week in June, described above, maximum floods during the last 3 days in June took place on the Root, La Crosse, and Whitewater tributary streams. The following will deal with those particular floods.

SOURCE OF FLOOD

Heavy thunderstorms with several periods of excessive rains occurred in the basins of the above-named tributaries beginning in the morning of the 28th and extending into the early morning of the 29th. At La Crosse, Wis., three excessive falls were recorded, one beginning at 9:19 a. m., one at 3:43 p. m., and one at 7:57 p. m. During the first period 1.11 inches fell in 20 minutes and 1.06 inches at the same rate in the second period. The storm total at La Crosse was 3.97 inches and 5.06 inches at Sparta, Wis. In the Root River Valley embracing a drainage area of 1,560 square miles, excessive rains of maximum proportion fell in the center of this area. Houston, Minn., reported 2.68 inches on the 28th, and Spring Grove, Minn., 3.19.

In the Whitewater drainage area, amounts varied greatly over the basin, as only 2.20 inches was reported at Beaver, Minn., yet maximum flood conditions followed.

It was apparent from synoptic reports and local conditions at La Crosse, Wis., that the area of heaviest rainfall was central over a belt covering the Root River Basin extending northeastward into the Whitewater, then eastward into Wisconsin over the lower Black River and La Crosse River Basins.

METEOROLOGICAL ANALYSIS—STORM OF JUNE 28–29, 1942

Contributing factors to the periods of excessive precipitation which occurred over the Root, Whitewater, and La Crosse River drainage basin during June 28 and early June 29, 1942, are as follows:

On the morning of June 28 a warm front separating exceptionally moist and unstable tropical air to the south and a shallow wedge of transitional polar air to the north lay along a line from east-central Minnesota southeastward along the Wisconsin-Minnesota border into central Illinois. At the same time a mass of polar air was moving eastward over Minnesota and Iowa with its forward edge extending along a line from east-central Minnesota south and southwestward through the southwestern corner of Iowa. Soundings taken in the moist tropical air at St. Louis, Mo., Omaha, Nebr., and St. Paul, Minn., show that the mixing ratio in the lower levels was in excess of 15 g./kg., and the air was both conditionally and convectively unstable. The intense general thunderstorm activity which produced the excessive rainfall during three periods between the morning of the 28th and the early morning of the 29th was due to the release of the potential energy in this moist unstable air mass.

During the first period (morning of the 28th) the potential energy was realized through horizontal convergence and lifting of the tropical air over the shallow wedge of polar air to the north. The second period occurred in the warm sector where latent energy was released largely through intense convergence of the moist tropical air preceding the passage of the cold front. The last period of intense rainfall was due to lifting and convergence of the unstable air associated with the passage of the cold front.

DAMAGES

The statistics of damage for these tributary floods are as follows:

1. Tangible property, buildings, highways, bridges, railroads	$24, 000
2. Agricultural losses:	
(a) Matured crops	20, 000
(b) Prospective crops	122, 500
(c) Livestock, farm equipment	6, 250
3. Suspension of business	10, 000
In this is included the suspension of traffic on the Chicago, Milwaukee & Saint Paul Railroad up the Root River Valley. Tracks were covered with water in several places.	
4. Value of property saved by warnings	7, 000

FLOOD CONDITIONS

On June 30, maximum flood conditions prevailed on both the Root and La Crosse Rivers and to a lesser extent on the Whitewater, where losses were greater due to excessive rains on upland areas than on the actual flood plain. On the Root River at Houston, Minn., the peak stage was 678.50 feet (m. s. l. elev.) at 7 a. m. of the 30th. (Zero elevation 1912 Adj. is 661.95.) The flood stage is 675 feet, the elevation at which floodwaters begin to cover agricultural land. The peak at West Salem on the La Crosse River as 7.66 feet on June 30th. (Flood stage approximately 7 feet.) and at Beaver on the Whitewater, 7.3 feet on the 29th. (Flood stage approximately 7 feet.) All gaging stations mentioned in the above are maintained by the U. S. Engineer Office at St. Paul, Minn. Due to the local character of the excessive rains, the Zumbro River Valley adjoining this experienced no flood conditions.

River District of Dubuque, Iowa, comprising the Mississippi River and tributaries between lock and dam Nos. 8 and 12:

Precipitation, during May, was quite well distributed throughout most of the central and northern portions of Wisconsin. Although the total amounts prior to May 19 had not been particularly great, they had been sufficient to establish a rather high soil-water content. From the 19th to the 25th of May, inclusive, the precipitation was scattered and mostly light, but the degree of soil saturation remained rather high, and it was increased by the general rain-fall of May 26, so that a high measure of run-off began almost immediately with the occurrence of the widespread and rather generally heavy rains which set in on the 28th, which were frequent to June 6, and intermittent thereafter to June 12. Precipitation was almost entirely in the form of local showers and thunderstorms, but they were so numerous and so frequent that, in the general effect, the results closely simulated conditions to be expected from general, uniformly distributed, and substantial rains.

Approximately half of the total precipitation for May fell in the latter period of 1 week. There were two areas of peak rainfall concentration, the centers being approximately at River Falls, Wis., and over a triangular area with apexes at Wausau, Knowlton, and Marshfield, Wis. Since River Falls is not in the Dubuque district, and will have to be considered with the precipitation over Minnesota, and because to do so would result in duplication, it is not being discussed in this report.

The Wausau-Knowlton-Marshfield triangle is approximately on the divide between and extends to the Wisconsin River on the east and to the Black River on the west. For the reasons set forth above, the following discussion is limited to the Wisconsin and Mississippi Rivers.

Above Wisconsin Dells, Wis., the Wisconsin River Valley experienced precipitation of such frequency and intensity during the last week of May 1942 that totals aggregated approximately half the monthly total, and were close to or exceeded the entire monthly normal. As previously mentioned, soil conditions were already highly favorable for a high measure of run-off. Consequently, the exceptionally heavy storms of the last 3 or 4 days of the month, particularly over the triangle already mentioned, produced a severe, flashy flood which crested at Knowlton at 6 p. m. on May 31. This has been termed as a severe flood merely on the basis of the crest stage and comparison with past records. It was not record breaking, however, and it did not do a large amount of damage in the Knowlton area. This absence of extensive damage was due to the fact that much of the flooded area has been acquired for reservoir area, currently in development, and the land has been unoccupied.

As this crest proceeded downstream it passed Wisconsin Rapids, Wis., at 6 p. m., June 1, and Portage at 3 p. m., June 4. Thereafter it tapered off considerably, primarily because the rainfall had not been particularly great at and below Wisconsin Dells. Precipitation continued to fall, almost daily, as the crest proceeded downstream. Ordinarily rains which fall after the crest occurs at Wisconsin Rapids have little or no influence upon subsequent crest stages at downstream points, but in this instance a second, but much less severe, crest developed at Knowlton at 7 a. m. on June 7. This second crest was largely "damped-out" before it reached Wisconsin Dells, but the rainfall period responsible for its development had extended well downstream and it made necessary an almost daily revision upward of crest estimates.

The time of the Wisconsin River flood was such that upon entering the Mississippi, it joined with the combined crests from above LaCrosse to produce, at Dubuque, the second highest stage of record for June. The crest was 19.34 feet at 2:15 a. m. on the 12th. The one higher June crest was 21.7 feet, the all-time high-water mark, recorded in 1880. Flood stages, however, were not attained at the other Mississippi river substations between LaCrosse and Dubuque.

Monetary losses, as river-flood damage, along the Wisconsin River totaled approximately $23,710 a substantial percentage of

which was in the Wisconsin Rapids area. Reports received indicated only about a $1,000 saving in property as a result of warnings, but there were, in addition, numerous comments indicating extensive savings, but without statements regarding the monetary values.

Along the Mississippi River (Dubuque district) the losses aggregated $65,276. The losses of prospective crops were especially heavy in the Lansing, Iowa, area. The next largest losses were in the suspension of contract construction work on Government boats and a new highway bridge over the Mississippi, at Dubuque. Operations at the Dubuque Municipal Airport had to be suspended, but most of the flying was continued elsewhere. Each of those activities suffered delays or suspension of activities for about three weeks.

River District of Davenport, Iowa, comprising the Mississippi River, and tributaries, between lock and dam Nos. 12 and 18:

The Rock River remained relatively high during the first 2 weeks of June 1942. On June 12 a rain of 2.45 inches was reported at Moline, Ill., and 1.89 inches at Galva, Ill. These rains and other moderate ones nearby, resulted in a crest stage of 10.05 feet at Moline, at 1 a. m., June 15. No material damage resulted from this rise.

Excessive local rains near Iowa Falls, Iowa, and heavy to excessive local rains in adjacent sections during the first 4 days of June 1942 resulted in flash floods on the Cedar River and tributaries and considerable soil erosion in Hardin, Grundy, and Black Hawk Counties in Iowa. The heaviest rain reported to Davenport was 6 inches on June 2 and 3, but totals around this amount were reported in nearby areas. Waterloo, Iowa, showed a stage of 12.2 feet at 2 p. m., of June 4th, the flood stage being 12 feet. One life was lost as the result of the flood and monetary losses have been estimated at over $340,000. Of this amount, more than $200,000 is attributed to crop losses. These figures do not include the damage to farm lands by erosion resulting from the excessive rains which are believed to reach a total of $1,000,000.

The mid-June flood on the Mississippi River in the Davenport River district had its inception in the upper reaches of the Wisconsin River Basin, in the last 4 days of May. Amounts of precipitation ranging from 5.84 inches at Wausau, Wis., to less than an inch at other places, were reported in this territory and the average was slightly over 3 inches for a 4-day period from May 28 to May 31. Heavy local rains following these conditions were reported on June 2–3, 6–7, and 12–13 over the upper Mississippi Valley which increased flood crests and were the primary cause of flood damage in the Davenport River district.

On the morning of June 3 and continuing through June 7, a steady rise on the Mississippi River for a week to 10 days was forecast, preparing people for flood warnings which were first issued on June 8.

The following crest stages were reached: Clinton, Iowa, 17.8 feet on June 13–14; Davenport, 15.2 feet on June 14–15; Muscatine, Iowa, 17.6 feet; and Keithsburg, Ill., 14.05 feet on June 15.

The losses from the flood waters have been estimated at $134,000, of which $98,000 is attributed to crops. No lives were lost.

River District of Burlington, Iowa, comprising the Mississippi River, and tributaries except the Des Moines River, between lock and dam Nos. 18 and 24:

A series of rains over portions of Minnesota, Wisconsin, Iowa, Illinois, and Missouri during the first part of June 1942 caused moderately heavy flooding on the Mississippi in this district during the middle and latter part of the month.

Flood warnings were issued June 6. Flood stage was first exceeded on June 9 at Hannibal, Mo., and the last station to pass flood stage was Burlington, Iowa, on June 14. The first date that the river fell below flood stage at any point was on June 19 at Burlington, Iowa, and the last point to fall below flood stage was at Louisiana, Mo., on June 28. The following crest stages were reached: Burlington, 15.5 feet, and Keokuk, Iowa, 15.8 feet, on June 16; Quincy, Ill., 17.7 feet on June 17; Hannibal, Mo., 17.7 feet on June 19; and Louisiana, Mo., 16.3 feet on June 20.

Heavy rains in northeastern Missouri near the end of the month caused the Salt River near New London, Mo., to rise rapidly reaching a crest of 25.5 feet (6.5 feet above flood stage) on June 29.

About 71,000 acres of prospective crops were flooded causing a loss of about $910,000. The most severe damage was in Pike County, Ill., where 44,600 acres were inundated with a loss of over $580,000. The total losses (all classes) in the Burlington river district have been estimated at about $927,000.

The River District of Cairo, Ill., comprising the Mississippi River from Cape Girardeau, Mo., to New Madrid, Mo.:

At the beginning of June 1942 the stage of the Mississippi River at Cape Girardeau, Mo., was moderately high, but a fall was in progress; by the 7th of the month the water level had declined to 20.1 feet. On the 7th, a series of rains began in the lower Missouri Valley and from that date until the 27th precipitation was reported daily at stations along that river and its numerous tributaries. Heavy rains also occurred during that period over the Illinois River watershed and over the Mississippi River above Cairo, Ill. These factors combined to produce a flood in the Mississippi River above Cairo. Throughout the month the Tennessee and Ohio Rivers remained low, a condition which decreased the flood height in the vicinity of the mouth of the Ohio.

The crest stage at Cape Girardeau, 36.9 feet, on July 2, while the highest ever reached during a summer month since establishment of the station on January 1, 1891, fell considerably short of the highest of record, 40.04 feet, which occurred on April 20, 1927, and the high-water mark of 42.5 feet in July 1844. For comparison the following summer high stages are mentioned:

	feet
June 14, 1903	36.53
July 18, 1909	35.00
June 11, 1935	36.35

The duration of the flood is given as from June 24 to July 10, 1942; these are the inclusive dates during which readings above 32 feet (flood stage) were made at Cape Girardeau, there being no other Weather Bureau river gage along the portion of the stream considered. Below the mouth of the Ohio, flood stage was not reached; however, high water did cause some damage to corn and cotton crops planted on lowlands in that area, and these losses are listed along with those which were sustained further up-stream.

A summary of losses reported in this District follows:

STATISTICS OF MONEY LOSSES BY FLOODS

State	Tangible property	Farm property			Suspension of business	Saved by warnings
		Matured crops	Prospective crops	Livestock		
Illinois	$6,075	$6,500	$110,000	0	$1,500	$10,000
Missouri	400	0	77,600	$420	1,900	8,900
Kentucky	200	0	79,840	0	0	0
Total for the district	6,675	6,500	267,440	420	3,400	18,900

NOTES

The acreage of farm land overflowed were: 4,050 in Illinois, 2,340 in Missouri, 3,200 in Kentucky—a total of 9,590 for the affected area.

The counties included in the above estimate are: Alexander, in Illinois; Cape Girardeau, Scott, Mississippi, and New Madrid in Missouri; and Ballard, Carlisle, Hickman, and Fulton in Kentucky.

No human life was lost and little harm was done to buildings.

Loss of livestock was held to a minimum by the rescue efforts of the U. S. Coast Guard unit based at Cairo, which removed a great many cows, hogs, horses, and chickens from the flooded area.

The region which was covered by water is sparsely settled and the removal of its inhabitants did not present as great a problem as in some previous floods.

A severe thunderstorm with excessive rainfall occurred in St. Louis, Mo., and surrounding territory, during the late evening of July 8, and continuing into the forenoon of July 9. The area of greatest intensity was centered over Florissant, Mo., 14 miles north-northwest of St. Louis, with another center of somewhat lesser intensity over East St. Louis, Ill. The greatest amount reported was 11 inches near Florissant from an unofficial measurement but believed to be reliable. The heaviest official measurements were 8.48 inches at East St. Louis and 7.50 inches at Grafton, Ill. The average length of duration of the storm was 11 hours.

Missouri River Basin.—Heavy rains in southeastern South Dakota, northwestern Iowa, and southwestern Minnesota late in June caused a general overflow of low

ground along the Big Sioux, Rock, and Floyd Rivers early in July, but the damage was slight.

Again late in July heavy rains occurring over approximately the same area caused moderate damage along the Big Sioux River from above Sioux Falls, S. Dak., to Sioux City, Iowa. Overflow was not as extensive as that which occurred in early June, except along Rock River from the mouth to above Rock Rapids where moderate overflow occurred and the Big Sioux from the mouth of the Rock River to below Akron, Iowa, where the overflow was nearly as extensive as in June. The crest at Akron was 18.3 feet on August 2. Below Akron the flood leveled off, due to low stages in the Missouri River.

West Gulf of Mexico drainage.—Unusually high floods occurred in the lower portions of the Guadalupe, Nueces, and Rio Grande Rivers during the early part of July. They were the result of almost continuous rains during the first 7 days of the month, becoming heavy at times. The rainfall and a comparison of the crest stages with previous high floods are shown in the accompanying table.

Floods of July 1942 in Guadalupe, Nueces, and Rio Grande Rivers and comparison with previous highest floods

Station and river	Years of record	Previous highest flood		July 1942 flood								
		Stage	date	Stage	Date	Precipitation and dates						
						1	2	3	4	5	6	7
Guadalupe:												
Gonzales, Tex.	39	38.3	May 1929	35.1	7	0.56	T	0.08	0.48	1.79	2.62	2.53
Cuero, Tex.	1	[1]43.2	July 1936	33.0	8	.36	0.45	.60	.76	2.95	2.50	3.10
Victoria, Tex.	39	30.7	July 1936	29.6	10	----	.26	.29	.44	5.64	3.01	1.96
Nueces:												
Cotulla, Tex.	25	32.4	June 1935	11.4	11	----	.15	.65	----	1.16	3.84	----
Three Rivers, Tex.	28	46.0	September 1919.	44.8	10	----	2.80	.31	.11	1.42	2.92	2.10
Rio Grande:												
Laredo, Tex.	26	49.6	September 1932.	16.5	6	----	.76	1.20	.35	.07	3.20	----
Rio Grande City, Tex.	31	34.8	----do----	21.6	7	----	----	.03	.14	.42	.20	----
Hidalgo, Tex.	11	26.0	----do----	21.2	9	----	----	----	----	.03	----	1.00
Mercedes, Tex.	11	22.6	September 1935.	23.4	9	.14	.02	----	----	.07	.31	.11
Brownsville, Tex.	17	19.7	October 1936.	19.4	11	1.12	----	.27	.01	T	.02	.12

[1] High-water mark.

The Guadalupe and Nueces Rivers were quite low at the beginning of the month, commenced to rise rapidly by the 5th and crested generally by the 8th to 10th. At Victoria, Tex., the lowermost station on the Guadalupe, the crest stage of 29.6 feet on the 10th was just 1.1 feet below the record high stage in July 1936, and at Three Rivers, Tex., the Nueces River crested at 44.8 feet on the 10th, 1.2 feet below the record high stage of September 1919.

The stages in the lower Rio Grande were moderately high on the 1st of July from a rise which occurred during the latter half of June. The river reached flood stage at Rio Grande City, Tex., on July 7 and at Mercedes and Brownsville, Tex.; it was above flood stage from July 6 to 12. The crest stage at Mercedes, 23.4 feet on July 9, was 0.8 foot above the record high stage of September 1935 and at Brownsville the crest of 19.4 feet on July 11 was just 0.3 foot below the previous high stage in October 1936.

In the lower Rio Grande Basin the losses were confined almost entirely to cotton and truck acreage planted inside the main levees from Brownsville to the mouth. The total losses in the flood have been estimated at about $200,000 to matured crops and $320,000 to prospective crops.

The losses in the Guadalupe and Nueces Rivers were as follows:

	Guadalupe	Nueces
Tangible property	$5,000	$48,500
Farm property:		
Matured crops	225,150	75,000
Prospective crops	145,000	125,000
Livestock and other movable property	3,050	6,500
Total losses	378,200	255,000
Money value of property saved by flood warnings	625,000	275,000

FLOOD-STAGE REPORT FOR JULY 1942

[All dates in July unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
HUDSON BAY DRAINAGE					
Red of North:	*Feet*			*Feet*	
Wahpeton, N. D.	6	June 7	June 8	6.4	June 8
Fargo, N. D.	17	June 10	June 12	17.7	June 11
ATLANTIC SLOPE DRAINAGE					
Sinnemahoning Creek: Sinnemahoning, Pa.	12	18	19	21.6	18
West Branch of Susquehanna:					
Renova, Pa.	16	18	19	18.9	18
Lock Haven, Pa.	21	19	19	22.0	19
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Meramec: Valley Park, Mo.	14	(1)	1	21.9	June 29
Mississippi:					
Hannibal, Mo.	13	9	10	13.4	10
Louisiana, Mo.	12	9	10	12.3	10
		15	15	12.1	15
Grafton, Ill.	18	(1)	3	21.7	June 29
St. Louis, Mo.	30	(1)	5	34.3	June 30
Chester, Ill.	27	(1)	10	34.0	1
Cape Girardeau, Mo.	32	(1)	9	36.9	2
Missouri Basin					
Big Sioux: Akron, Iowa	12	June 28	3	14.0	June 29
		31	(2)	18.3	Aug. 2
Floyd: James, Iowa	14	June 29	2	16.8	June 30
Grand: Brunswick, Mo.	12	(1)	6	21.8	June 29
Missouri:					
Lexington, Mo.	18	(1)	7	24.3	June 27
Waverly, Mo.	18	(1)	3	21.8	June 27
Boonville, Mo.	21	(1)	6	27.5	June 29
Hermann, Mo.	21	(1)	7	29.4	June 28
St. Charles, Mo.	25	(1)	8	34.8	June 29
Ohio Basin					
Allegheny:					
Red House, N. Y.	14	20	20	14.6	20
Warren, Pa.	12	20	21	12.5	20
North Fork of Kentucky:					
Hazard, Ky.	20	9	9	21.5	9
Jackson, Ky.	28	9	10	32.4	9
WEST GULF OF MEXICO DRAINAGE					
Guadalupe:					
Gonzales, Tex.	20	6	8	35.1	7
Cuero, Tex.	23	7	10	33.0	8
Victoria, Tex.	21	7	12	29.6	10
Nueces: Three Rivers, Tex.	37	7	13	44.8	10
Rio Grande:					
Rio Grande City, Tex.	21	7	7	21.6	7
Hidalgo, Tex.	21	9	9	21.2	9
Mercedes, Tex.	21	6	11	23.4	9
Brownsville, Tex.	18	6	12	19.4	11

[1] Continued from previous month.
[2] Continued into following month.

CLIMATOLOGICAL DATA

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW, January 1940, p. 32]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	81.0	+0.7	Talladega	104	20	Valley Head	57	3	4.83	−0.53	Highland Home	12.34	Guntersville Dam	0.73
Arizona	81.4	+1.2	2 stations	120	[1] 6	Alpine	33	4	1.33	−.84	Young	4.08	3 stations	.00
Arkansas	81.1	+.6	Conway	105	31	2 stations	53	[1] 23	1.39	−2.38	Heber Springs	6.60	Index	.00
California	73.8	+.2	Cow Creek	126	24	Boca	29	12	.01	−.06	Blythe	1.20	222 stations	.00
Colorado	68.0	+.8	Las Animas	106	[1] 12	Fraser	21	3	1.41	−.74	Pray	3.69	2 stations	T
Florida	83.2	+1.9	2 stations	105	21	2 stations	61	[1] 16	4.85	−2.42	Jasper	17.75	Key West	.33
Georgia	81.3	+1.2	3 stations	106	[1] 19	Hollywood	58	3	4.79	−.99	Dahlonega	9.65	Atlanta	1.36
Idaho	69.2	+1.0	Nampa	110	4	Sun Valley	25	[1] 13	.54	−.13	Priest River	2.60	14 stations	.00
Illinois	76.8	+.3	East St. Louis	101	30	Freeport	44	2	4.89	+1.62	Grafton	11.98	Cairo	.62
Indiana	76.2	+.5	Seymour	101	17	2 stations	42	7	4.03	+.70	Logansport	9.44	Cypress	1.10
Iowa	74.3	−.4	Sioux City	105	17	Decorah	42	7	4.89	+1.22	Cedar Falls	11.51	Clarinda Erosion	1.33
Kansas	80.0	+.8	Hoxie	111	13	Oberlin	48	1	2.25	−.86	El Dorado	6.65	Arkansas City	.11
Kentucky	78.1	+1.0	2 stations	101	[1] 16	Lynch (near)	48	26	4.71	+.46	Quicksand	10.96	Lovelaceville	.84
Louisiana	81.8	.0	Lake Providence	103	15	Robeline	61	24	4.63	−1.54	Houma	12.94	2 stations	.56
Maryland-Delaware	76.1	+.8	Pocomoke City, Md.	102	19	Sines, Md	44	8	4.69	+.35	Elkton, Md	8.62	Luke, Md	1.63
Michigan	68.1	−1.2	3 stations	100	[1] 17	3 stations	30	2	3.46	+.73	Ironwood	10.12	Hulbert	1.46
Minnesota	68.0	−2.1	2 stations	100	16	do	36	[1] 4	3.35	+.10	Argyle	7.89	Fergus Falls	.40
Mississippi	82.0	+.9	do	103	[1] 16	Batesville	58	24	2.87	−2.25	Fruitland Park	9.53	Columbus	.13
Missouri	78.8	+.7	Poplar Bluff	104	19	4 stations	50	[1] 1	2.85	−.75	Bonnville	9.32	Zalma	.22
Montana	66.9	−.3	Crow Agency	103	22	Conway's Ranch	26	[1] 12	1.25	−.14	Babb (near)	4.26	2 stations	.18
Nebraska	76.6	+1.0	5 stations	107	[1] 16	Mumper	42	21	1.54	−1.54	Blair	5.11	Curtis	.19
Nevada	76.0	+3.4	Overton	120	20	Spooner's Station	29	12	.10	−.28	Alamo	1.04	21 stations	.00
New England	68.5	−.6	3 stations	96	[1] 14	2 stations	36	9	4.32	+.57	Salisbury, Conn	8.28	E. Ryegate, Vt	.82
New Jersey	74.6	+.8	Burlington	105	19	Charlotteburg	41	10	7.30	+2.61	Long Branch	12.28	Barnegat City	3.90
New Mexico	72.9	+3.2	Carlsbad	109	13	Red River	31	2	1.51	−.99	Grenville	8.96	Burnham's Trading Post.	.01
New York	69.7	−.1	2 stations	99	[1] 14	Wiscoy	30	7	5.04	+1.12	Scio	11.77	Ogdensburg	1.35
North Carolina	78.6	+1.6	do	107	18	Mount Mitchell	47	3	5.14	−.78	Mount Mitchell	11.42	Manteo	.54
North Dakota	67.1	−1.9	3 stations	97	[1] 11	Casselton	36	6	2.43	−.01	Grafton	5.66	Van Hook	.22
Ohio	74.7	+1.0	Lancaster	102	18	Bellefontaine	43	7	3.98	+.17	Jefferson	7.80	Dennison	1.25
Oklahoma	81.4	−.3	Alva	109	31	Kenton	49	2	1.49	−1.31	Quinton	4.63	2 stations	.00
Oregon	67.4	+.9	Echo	112	3	Chemult	25	29	.43	+.01	Cloverdale	3.26	10 stations	.00
Pennsylvania	72.6	+.4	Phoenixville	102	20	Kane	35	9	5.15	+.87	Coudersport	14.39	Sutersville	1.00
South Carolina	81.6	+1.7	Blackville	105	19	Caesars Head	58	9	6.06	+.21	Caesars Head	12.38	Myrtle Beach	2.12
South Dakota	71.7	−1.5	Wagner	108	17	Camp Crook	35	1	2.52	+.11	2 stations	7.24	Belle Fourche	.57
Tennessee	79.8	+2.1	3 stations	103	[1] 15	Rugby	50	3	4.84	+.32	Kingston	11.77	Union City	.25
Texas	81.6	−1.4	Fort Stockton	108	9	Stratford	50	22	3.53	+.90	Goose Creek	16.88	6 stations	.00
Utah	73.3	+1.5	St. George	111	6	Clear Creek	35	2	.75	−.16	Bryce Canyon	2.64	2 stations	.00
Virginia	77.1	+1.7	Warsaw	106	20	2 stations	47	[1] 3	4.28	−.36	Halifax	9.71	Cape Henry	.95
Washington	68.4	+1.8	Wahluke (near)	113	3	Deer Park (near)	31	12	1.28	+.62	Carbon River Entrance.	5.22	4 stations	.00
West Virginia	73.9	+.7	2 stations	103	[1] 18	Brandywine	41	8	4.44	−.18	Williamson	8.35	Moorefield	1.38
Wisconsin	69.0	−1.2	Waupaca	101	18	3 stations	36	[1] 2	4.27	+.78	Rest Lake	11.84	Whitewater	1.60
Wyoming	67.2	+1.4	Hawk Springs	105	14	Northeast Entrance	18	13	1.07	−.27	Yoder	3.69	Border	T
Alaska (June)	54.0	+1.5	Allakaket	92	26	Barrow	16	4	1.85	+.12	Whittier	18.12	Council	.15
Hawaii	75.4	+1.0	Waianae	93	[1] 12	2 stations	50	[1] 1	5.28	−.82	Kukui	48.00	3 stations	.00
Puerto Rico	79.6	+.9	2 stations	98	[1] 16	Guineo Reservoir	59	14	7.22	+1.00	Rio Blanco	16.00	Mona Island	2.32

[1] Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer temperature of the dewpoint	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Number of days with thunderstorms
New England	*Ft.*	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°F.	°F.	°F		°F	°F		°F	°F	°F.	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*	
							67.7	**−0.2**									**81**	**3.74**	**+0.2**										**5.8**			
Eastport	75	67	85	29.88	29.96	+0.03	59.6	−0.8	82	25	68	47	3	52	25	56	54	87	2.62	−.5	14	7.2	s.	20	sw.	1	8	11	12	6.0	.0	.0	1
Greenville, Maine	1,070	6	41	28.82	29.97	.....	63.9	−1.1	88	13	76	42	9	52	37	60	57	...	3.12	−1.4	13	.....	nw.	.....	.....	...	4	17	10	.....	.0	.0	4
Portland, Maine [1]	103	5	36	29.84	29.95	.00	66.8	.....	92	14	77	45	10	57	31	62	60	80	5.01	+1.8	13	6.9	s.	29	w.	8	11	10	10	5.3	.0	.0	5
Concord [2]	289	4	45	29.65	29.96	.00	68.0	−.5	94	19	80	43	10	56	38	63	60	78	5.02	+1.5	12	5.8	nw.	23	nw.	15	11	13	7	5.2	.0	.0	7
Burlington [2]	403	11	48	29.50	29.93	−.01	68.4	−1.9	94	19	78	45	10	59	29	63	60	74	2.21	−1.3	13	7.1	s.	23	s.	11	5	9	17	6.6	.0	.0	6
Northfield	876	12	60	29.03	29.96	+.02	65.7	−.2	92	19	77	39	10	54	36	...	...	...	1.41	−2.2	13	6.6	sw.	27	sw.	8	3	12	16	6.9	.0	.0	5
Boston [1]	124	33	62	29.83	29.96	.00	71.1	.....	93	14	79	58	10	63	27	64	61	75	4.14	+.6	12	9.0	sw.	30	nw.	6	5	12	14	6.8	.0	.0	3
Nantucket	12	10	63	29.96	29.98	.00	68.6	+.8	84	26	75	58	11	62	23	64	63	88	2.18	−.7	7	10.4	sw.	25	ne.	22	10	8	13	5.8	.0	.0	2
Block Island	159	46	60	29.81	29.98	+.01	72.8	−.6	95	14	82	58	31	64	27	65	63	81	4.56	+1.3	9	7.4	sw.	26	sw.	8	5	15	11	6.2	.0	.0	4
Providence [2]	159	5	.....	29.80	29.96	−.01	72.4	.....	93	14	82	53	9	63	31	66	63	77	4.47	+.1	12	7.2	s.	27	n.	14	7	12	12	6.1	.0	.0	6
Hartford [1]	159	5	.....	29.80	29.96	−.01	72.4	.....	93	14	82	53	9	63	31	66	63	77	4.47	+.1	12	7.2	s.	27	n.	14	7	12	12	6.1	.0	.0	6
New Haven [2]	107	74	153	29.86	29.98	+.01	73.2	+1.4	93	14	82	58	10	65	23	67	65	83	7.45	+3.1	11	7.4	s.	22	sw.	8	10	14	7	4.9	.0	.0	4
																													5.7			
Middle Atlantic States							**76.9**	**+1.8**									**74**	**5.60**	**+0.3**													
Albany [1]	97	26	40	29.85	29.96	.00	71.0	+.1	96	19	81	48	10	61	32	64	61	74	6.58	+3.8	14	7.3	s.	28	w.	29	5	13	13	6.6	.0	.0	9
Binghamton	871	57	79	29.08	29.99	+.02	71.6	+1.6	95	19	83	45	10	60	37	64	61	73	4.67	+1.0	13	5.1	w.	21	ne.	17	3	14	14	6.8	.0	.0	12
New York	314	415	454	29.64	29.96	−.02	74.9	+1.1	93	20	82	59	7	68	21	67	62	70	6.24	+2.0	13	12.2	sw.	48	nw.	14	11	9	11	5.4	.0	.0	11
Harrisburg [1]	374	30	49	29.59	29.99	+.01	76.0	+1.2	95	19	86	57	7	66	33	68	65	74	5.53	+1.7	12	6.0	sw.	27	n.	29	6	13	12	6.4	.0	.0	14
Philadelphia [2]	114	174	367	29.86	29.98	.00	78.0	+1.8	98	19	86	65	8	70	20	69	65	72	6.74	+2.6	12	10.5	sw.	33	sw.	6	6	17	8	5.6	.0	.0	7
Reading	323	47	306	29.65	29.99	.....	76.4	+1.0	96	19	86	57	10	67	29	...	...	...	5.60	+1.3	11	8.8	nw.	40	sw.	18	9	11	11	5.7	.0	.0	9
Scranton	805	72	104	29.14	29.98	.00	72.7	+1.0	94	19	82	50	10	63	34	...	...	...	5.08	+1.0	3	5.7	sw.	39	se.	6	7	17	7	5.7	.0	.0	9
Atlantic City	52	37	172	29.93	29.98	.00	76.3	+4.2	99	19	82	65	10	70	26	69	67	77	5.44	+1.5	11	12.5	w.	39	se.	11	7	15	9	5.4	.0	.0	11
Trenton	190	89	107	29.78	29.98	.....	76.0	+1.5	96	19	85	59	10	67	24	68	64	72	4.35	+.4	15	7.2	s.	26	sw.	6	8	13	10	6.0	.0	.0	10
Baltimore [2]	123	100	215	29.86	29.99	+.01	79.7	+2.5	99	19	88	65	8	71	22	70	66	69	4.46	−.2	10	8.6	sw.	35	nw.	29	9	11	11	5.5	.0	.0	11
Washington [1]	112	62	85	29.93	30.00	.00	78.8	+2.0	99	19	88	64	8	70	26	70	67	72	5.40	+.7	11	5.6	sw.	36	w.	31	9	14	8	5.3	.0	.0	6
Cape Henry	18	8	54	29.97	29.99	.....	80.0	+2.5	99	14	87	66	10	72	26	74	71	78	.95	−4.4	10	8.6	sw.	47	nw.	6	10	16	5	4.7	.0	.0	7
Lynchburg	686	144	184	29.30	30.01	.00	79.5	+2.0	100	17	90	57	8	69	29	70	67	72	2.02	−2.2	11	5.7	w.	27	nw.	6	11	11	9	5.1	.0	.0	9
Norfolk [2]	91	80	125	29.91	30.01	+.01	82.0	+3.3	104	18	91	67	9	74	25	73	71	76	1.61	−4.1	11	7.8	w.	33	nw.	6	7	13	11	5.9	.0	.0	11
Richmond [2]	144	11	52	29.85	30.00	−.01	80.0	+1.5	100	20	89	64	24	71	26	72	70	81	4.31	−.4	12	6.1	sw.	31	nw.	6	9	15	7	4.9	.0	.0	12
																													5.6			
South Atlantic States							**81.0**	**+2.8**									**78**	**5.09**	**−0.7**													
Asheville	2,253	89	104	27.79	30.06	+.04	74.6	+2.9	92	20	85	56	3	64	30	67	65	82	3.95	−.4	13	5.2	nw.	26	nw.	10	3	11	17	7.0	.0	.0	11
Charlotte [2]	779	63	86	29.22	30.03	+.01	81.1	+2.7	99	20	90	66	2	72	24	72	70	78	5.58	+.5	10	5.2	sw.	23	n.	11	7	9	15	6.2	.0	.0	12
Greensboro [1]	886	6	56	29.12	30.04	.....	77.8	.....	97	20	88	58	8	68	29	71	69	79	4.26	...	8	6.0	sw.	30	w.	10	10	10	11	5.8	.0	.0	9
Hatteras	11	5	50	30.00	30.01	.00	81.5	+3.3	95	20	87	70	1	76	14	77	75	84	1.40	−4.1	8	10.7	sw.	28	n.	6	10	13	8	5.3	.0	.0	10
Raleigh [1]	376	27	69	29.63	30.02	.00	81.3	+2.5	102	20	92	66	9	71	28	73	71	78	3.15	−2.2	11	7.0	sw.	30	nw.	8	7	7	17	6.4	.0	.0	10
Wilmington	72	73	107	29.96	30.03	+.02	82.8	+3.7	101	19	91	68	8	74	24	75	73	79	3.63	−3.5	12	7.9	sw.	30	nw.	8	11	16	4	4.7	.0	.0	14
Charleston [2]	48	11	92	29.99	30.04	+.01	84.1	+2.7	101	19	92	68	22	76	23	76	74	83	7.37	+.5	12	8.5	sw.	33	nw.	22	14	11	6	4.5	.0	.0	12
Columbia, S. C. [2]	347	70	91	29.66	30.03	+.01	83.0	+2.1	104	20	93	67	3	73	26	75	73	79	7.24	+1.9	12	6.7	w.	23	s.	3	3	14	14	6.7	.0	.0	14
Greenville, S. C. [1]	1,040	70	78	28.97	30.04	.....	79.9	+3.0	98	20	90	64	3	70	26	71	69	75	4.73	−.6	17	6.7	w.	39	w.	29	3	14	14	6.7	.0	.0	14
Augusta [2]	182	62	77	29.85	30.04	+.02	83.3	+2.0	102	20	93	69	3	74	26	73	70	76	5.92	+.5	11	5.2	w.	24	nw.	9	12	12	7	4.8	.0	.0	12
Savannah [2]	65	73	152	29.99	30.06	+.03	84.7	+3.2	103	21	94	70	23	75	25	75	72	77	9.09	+2.4	13	8.7	w.	32	nw.	6	13	11	7	4.8	.0	.0	12
Jacksonville [2]	43	86	110	30.04	30.08	+.05	84.4	+2.3	102	21	94	69	14	75	26	75	73	76	3.98	−2.7	14	6.0	sw.	28	sw.	22	8	21	2	4.9	.0	.0	16
																													4.4			
Florida Peninsula							**84.8**	**+2.9**									**78**	**2.28**	**−3.3**													
Key West [2]	21	10	64	30.04	30.06	+.03	85.2	+1.7	92	23	90	76	11	80	14	79	76	78	.33	−3.0	8	9.6	e.	24	e.	28	7	23	1	4.5	.0	.0	11
Miami [2]	25	124	168	30.04	30.07	+.03	84.5	+3.5	95	21	90	71	23	80	21	77	74	77	1.24	−4.2	7	7.6	e.	24	e.	31	12	16	3	4.2	.0	.0	15
Tampa [1]	35	5	61	30.06	30.09	+.05	84.6	+3.4	98	21	93	68	15	76	22	76	74	78	5.28	−2.7	14	7.6	s.	36	s.	15	8	21	2	4.6	.0	.0	23
																													5.6			
East Gulf States							**82.0**	**+1.0**									**79**	**4.41**	**−1.3**													
Atlanta [1]	1,173	5	72	28.86	30.05	+.03	80.4	.....	96	30	90	66	2	71	26	72	69	77	4.60	−.2	13	7.7	w.	46	nw.	14	7	11	13	6.1	.0	.0	16
Macon [2]	370	79	87	29.67	30.06	+.04	82.2	+1.0	99	21	92	69	25	72	24	73	71	77	3.02	−1.7	14	6.0	w.	25	sw.	25	8	12	11	6.1	.0	.0	13
Thomasville	273	49	58	29.81	30.10	+.07	82.2	+.4	100	21	93	68	3	72	27	...	...	...	5.01	−1.7	13	.....	.....	.....	.....	...	3	16	12	.....	.0	.0	13
Apalachicola	35	11	51	30.04	30.08	.....	83.4	+1.7	98	21	90	72	2	76	20	76	74	77	4.90	−2.8	10	6.0	w..	24	s.	25	13	9	9	4.8	.0	.0	25
Pensacola	56	54	79	30.02	30.08	+.07	82.5	+1.5	100	21	90	71	14	76	21	76	74	79	5.63	−1.1	15	5.8	w.	26	w.	22	10	12	9	5.3	.0	.0	17
Pensacola	56	54	79	30.02	30.08	+.07	82.5	+1.5	100	21	90	71	14	76	21	76	74	79	5.63	−1.1	15	5.8	w.	26	w.	22	10	12	9	5.3	.0	.0	17
							79.6	**+1.7**											6.66	+1.5	12	.....	s.	.....	.....	...	3	25	3	.....	.0	.0	5
Anniston	741	9	.....	.....	.....	.....	79.6	+1.7	97	20	90	65	24	69	28	...	...	...	2.15	−3.0	17	5.2	sw.	19	nw.	30	4	19	8	5.8	.0	.0	19
Birmingham [2]	700	11	48	29.35	30.08	+.07	81.0	+.8	99	20	91	67	3	71	24	72	70	79	6.73	−.2	21	5.0	s.	25	s.	22	2	17	12	6.6	.0	.0	19
Mobile [2]	57	6	30	30.02	30.08	+.07	82.4	+1.0	98	21	91	71	29	74	23	74	73	85	3.95	−.9	13	5.7	sw.	27	n.	31	11	9	11	5.3	.0	.0	13
Montgomery [2]	218	92	105	29.84	30.07	+.05	82.0	+.3	99	21	91	70	8	73	22	74	72	79	3.95	−.9	13	5.7	sw.	27	n.	11	14	9	8	5.1	.0	.0	12
Meridian [2]	375	67	92	29.68	30.07	+.05	81.7	+1.3	99	21	91	68	2	72	23	74	71	76	1.15	−3.7	8	5.3	sw.	18	s.	11	14	9	8	5.1	.0	.0	9
Vicksburg [2]	247	82	102	29.81	30.07	+.07	81.9	+.6	96	21	90	70	24	74	21	74	72	81	.39	−4.1	7	6.3	sw.	27	ne.	15	8	15	8	5.1	.0	.0	9
New Orleans [2]	53	76	84	30.01	30.07	+.07	83.3	+.9	96	14	90	70	26	76	18	76	74	81	8.70	+2.3	16	4.5	se.	27	ne.	15	4	16	11	6.3	.0	.0	23
																													5.1			
West Gulf States							**82.4**	**−0.2**									**74**	**4.91**	**+1.6**													
Shreveport [1]	249	92	227	29.79	30.05	+.07	83.9	+.7	101	14	94	66	25	73	27	73	71	72	.56	−3.0	5	7.3	sw.	34	e.	15	11	16	4	4.7	.0	.0	6
Bentonville	1,303	12	51	28.68	30.02	+.05	78.0	−.5	96	16	89	56	23	67	30	...	...	...	.82	−3.5	3	8.2	sw.	24	nw.	10	10	10	3	3.5	.0	.0	4
Fort Smith	463	57	82	29.54	30.00	+.03	82.4	+.9	100	16	92	64	2	73	26	72	68	65	1.79	−1.6	4	5.8	e.	27	n.	10	18	10	3	4.3	.0	.0	7
Little Rock [2]	357	94	102	29.66	30.04	+.05	82.6	+1.7	101	16	94	64	24	72	30	73	69	69	.86	−2.6	3	7.9	sw.	24	nw.	20	13	13	5	4.3	.0	.0	2
Austin [2]	605	68	90	29.40	30.02	.....	82.0	−2.0	98	21	91	66	24	73	30	73	70	76	3.69	+1.4	6	8.3	s.	36	sw.	29	11	17	3	4.8	.0	.0	10
Brownsville [2]	57	88	96	29.94	29.99	.....	83.8	+.2	97	22	92	70	24	76	23	76	74	80	.62	...	9	8.7	se.	25	se.	13	2	21	8	6.2	.0	.0	10
Corpus Christi [2]	20	11	78	30.00	30.02	+.06	83.7	+1.0	97	22	90	70	27	77	19	76	75	85	10.26	+8.7	7	9.5	s.	32	ne.	1	8	11	12	5.9	.0	.0	13
Dallas [1]	512	6	46	29.48	30.02	.....	84.2	.....	99	15	95	64	23	74	30	72	67	63	T	−2.9	0	10.8	s.	32	s.	29	15	10	6	4.4	.0	.0	1
Fort Worth [1]	679	35	56	29.32	30.02	+.06	84.8	+1.2	103	15	97	65	23	73	31	72	67	62	.62	−2.0	2	10.9	s.	27	s.	18	14	10	7	4.4	.0	.0	1
Galveston [2]	54	106	114	29.99	30.04	+.06	82.4	−1.0	92	15	87	67	3	78	19	77	75	81	13.79	+10.1	12	8.5	s.	31	nw.	5	7	13	11	6.0	.0	.0	12
Houston [2]	138	157	190	29.90	30.04	.....	81.8	−1.9	94	13	89	69	22	75	20	75	74	83	14.10	+10.1	15	7.5	se.	27	se.	28	3	16	12	6.5	.0	.0	15
Palestine	510	64	72	29.53	30.05	+.08	81.8	−.4	96	16	91	67	25	73	24	73	70	73	1.01	−1.7	8	6.3	s.	22	se.	29	16	9	6	4.2	.0	.0	5
Port Arthur	34	59	134	30.01	30.05	.....	82.6	.....	96	15	90	70	6	76	24	75	73	78	8.17	+1.2	16	9.6	s.	42	se.	15	6	14	11	6.2	.0	.0	18
San Antonio [1]	693	28	59	29.31	30.02	+.07	81.2	−2.6	96	14	91	65	24	72	28	73	70	77	8.19	+6.0	12	7.1	se.	31	n.	1	4	19	8	6.0	.0	.0	10

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dewpoint	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Number of days with thunderstorms
Ohio Valley and Tennessee	*Ft.*	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°F.	°F.	°F		°F	°F		°F	°F	°F	°F.	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*	
							77.5	+1.4										76	4.30	+0.5											5.3			
Chattanooga [1]	762	21	54	29.26	30.05	+0.03	79.5	+2.1	98	20	90	59	3	68	28	72	70	79	5.03	+.8	11	4.9	s.	39	sw.	27	2	19	10	6.4	.0	.0	16
Knoxville [2]	995	66	84	29.02	30.06	+.04	78.8	+1.7	96	17	89	63	3	68	26	71	68	78	9.19	+4.8	13	6.8	sw.	43	nw.	10	4	18	9	5.9	.0	.0	16
Memphis [2]	399	78	86	29.62	30.02	+.02	82.8	+2.1	101	16	93	63	3	72	27	74	70	71	1.78	−1.4	4	7.7	sw.	22	sw.	10	19	11	1	3.7	.0	.0	6
Nashville [1]	546	5	72	29.46	30.04	+.03	81.3	-----	97	19	92	59	3	71	30	72	69	73	2.77	−1.1	12	6.9	sw.	30	w.	14	10	9	12	5.4	.0	.0	12
Lexington	989	6	----	29.00	30.04	+.03	78.2	+2.3	96	17	90	57	3	67	28	----	----	----	8.16	+4.5	10	----	sw.	----	----	----	19	7	5	3.7	.0	.0	10
Louisville [2]	525	106	120	29.47	30.02	+.02	79.7	+1.1	96	30	88	58	7	71	24	71	68	75	1.96	−1.7	4	7.5	sw.	26	sw.	30	10	15	6	4.8	.0	.0	5
Evansville [1]	431	5	38	29.56	30.01	+.01	78.5	−.4	96	30	89	57	7	68	27	71	68	74	1.54	−1.9	8	6.5	sw.	30	sw.	30	10	14	7	5.4	.0	.0	10
Indianapolis [2]	823	98	129	29.14	30.01	+.02	78.2	+2.5	98	17	88	55	7	69	25	70	67	79	2.91	−.4	10	6.9	sw.	21	w.	6	9	15	7	5.1	.0	.0	12
Terre Haute [2]	575	68	149	29.41	30.01	-----	78.1	-----	98	17	88	56	7	69	24	71	69	78	4.39	+1.2	12	7.8	sw.	27	nw.	29	10	18	3	4.6	.0	.0	13
Cincinnati [2]	627	11	51	29.35	30.01	+.01	77.0	+1.9	95	17	87	54	7	67	25	70	67	76	4.77	+1.5	11	5.8	sw.	18	nw.	13	10	14	7	4.9	.0	.0	15
Columbus [2]	822	90	110	29.16	30.01	+.01	76.8	+1.9	98	17	87	55	7	67	27	68	65	75	2.57	−1.0	13	8.2	s.	31	sw.	3	7	12	12	5.9	.0	.0	7
Dayton [2]	900	186	213	29.07	30.01	-----	76.6	+1.2	95	17	86	55	7	67	25	68	64	72	3.82	+.5	13	8.3	sw.	35	w.	6	6	15	10	5.6	.0	.0	12
Elkins [2]	1,947	61	78	28.05	30.05	+.04	71.4	+1.1	91	17	82	52	8	61	31	66	64	86	7.48	+2.1	16	4.7	nw.	31	nw.	20	3	13	15	6.8	.0	.0	9
Parkersburg	637	77	84	29.35	30.02	+.01	76.0	+.6	96	17	86	56	7	66	29	69	67	78	3.97	−.3	11	4.3	se.	30	nw.	4	9	11	11	5.5	.0	.0	10
Pittsburgh [1]	842	39	54	29.12	30.01	+.01	73.9	−.1	95	18	84	55	7	64	26	66	62	74	4.15	+.1	12	9.2	sw.	30	n.	31	3	14	14	6.4	.0	.0	10
Lower Lake Region							71.6	+0.6										71	4.09	+0.8										4.9			
Buffalo [2]	768	243	280	29.17	29.98	+.01	68.0	−1.8	83	25	74	52	9	62	25	63	59	72	2.42	−.6	11	12.8	sw.	38	sw.	5	10	10	11	5.4	.0	.0	
Canton	448	10	61	29.46	29.93	-----	69.0	+.1	91	13	80	46	10	58	31	62	58	69	5.49	+2.0	9	7.5	w.	27	sw.	13	8	12	11	6.0	.0	.0	5
Ithaca	836	77	100	-----	-----	-----	70.6	+.1	94	19	82	45	10	59	37	----	----	----	5.54	+2.0	16	6.4	nw.	24	nw.	19	7	11	13	6.3	.0	.0	7
Oswego	335	71	85	29.60	29.96	.00	69.7	−.7	92	13	77	53	10	62	31	64	60	75	2.74	−.2	13	7.2	w.	24	nw.	14	17	9	5	4.1	.0	.0	8
Rochester [1]	523	5	69	29.42	29.98	+.01	71.0	+.3	95	13	82	47	7	60	35	64	59	70	2.84	−.1	9	8.6	w.	37	w.	5	9	11	11	5.6	.0	.0	5
Syracuse [1]	596	5	51	29.34	29.97	.00	70.8	+1.5	94	19	82	46	10	60	37	65	61	73	2.72	−1.0	13	8.3	sw.	36	sw.	19	10	12	9	5.2	.0	.0	6
Erie [2]	714	57	81	29.24	30.00	+.02	71.6	+.6	91	17	78	52	3	65	30	65	62	77	4.12	+1.1	15	7.4	w.	22	w.	18	9	17	5	5.1	.0	.0	5
Cleveland [1]	762	27	54	29.19	29.99	.00	73.8	-----	96	17	84	53	7	64	32	66	62	69	4.09	+.6	14	8.5	sw.	40	s.	3	12	11	8	5.1	.0	.0	11
Sandusky	629	5	67	-----	-----	-----	75.4	+2.0	100	17	85	55	7	66	29	----	----	----	4.91	+1.5	11	7.6	sw.	24	nw.	30	12	14	5	4.4	.0	.0	10
Toledo [2]	628	79	87	29.33	30.00	+.01	74.5	+1.3	97	17	84	53	7	65	26	67	64	74	3.47	+.4	8	8.6	w.	24	w.	3	25	6	0	2.3	.0	.0	8
Fort Wayne [1]	857	69	84	29.10	30.00	-----	73.4	+1.0	95	17	84	51	7	62	29	67	63	73	7.42	+3.8	11	7.0	sw.	43	w.	3	12	13	6	4.6	.0	.0	9
Detroit [1]	730	5	78	29.22	29.99	+.01	73.6	+2.6	99	18	84	50	7	64	28	65	61	66	3.35	.0	13	8.6	w.	32	nw.	19	9	18	4	4.9	.0	.0	10
Upper Lake Region							68.8	+0.8										74	3.25	+0.1										5.4			
Alpena	609	5	89	29.32	29.98	+.01	66.2	+.3	91	13	76	43	2	57	29	61	57	75	1.82	−.9	14	9.9	nw.	29	nw.	14	10	13	8	5.0	.0	.0	6
Escanaba	612	51	72	-----	29.97	.00	65.8	−.2	87	10	75	44	8	57	----	----	----	75	3.99	+.7	12	9.2	s.	31	n.	7	9	13	9	----	.0	.0	8
Grand Rapids	707	70	244	29.22	29.97	−.01	73.0	+3.1	95	17	82	53	9	64	31	65	62	73	4.08	+1.2	7	9.2	sw.	36	sw.	19	15	11	5	3.9	.0	.0	6
Lansing [2]	878	5	90	29.06	30.00	-----	70.2	−.7	92	17	80	48	2	61	29	65	61	73	4.33	+1.2	11	6.6	sw.	21	s.	26	12	10	9	4.7	.0	.0	8
Marquette	734	44	73	29.16	29.96	.00	64.5	−.4	93	12	74	45	8	56	27	58	54	72	3.30	+.2	10	7.1	w.	29	sw.	18	6	14	11	6.0	.0	.0	6
Sault Sainte Marie [1]	614	11	43	29.29	29.96	−.01	62.7	-----	91	18	74	38	2	52	35	58	55	80	1.47	−1.2	14	9.9	nw.	35	nw.	14	7	10	14	6.4	.0	.0	6
Chicago	673	7	131	29.28	29.99	+.01	75.2	+2.7	100	17	85	53	7	65	27	66	62	71	4.01	+.6	10	7.7	sw.	34	sw.	26	8	15	8	5.2	.0	.0	10
Green Bay	617	109	141	29.32	29.98	+.01	69.9	−.	195	18	80	50	2	60	26	62	58	70	1.88	−1.6	8	9.0	sw.	31	s.	13	5	17	9	6.3	.0	.0	5
Milwaukee [1]	681	33	66	29.26	29.98	+.01	71.4	+3.	298	17	81	49	2	62	27	65	61	71	3.58	+.8	9	10.1	sw.	35	sw.	12	10	11	10	5.4	.0	.0	8
Duluth	1,133	5	47	28.75	29.96	+.01	63.2	−.	788	11	72	45	4	54	28	58	55	76	4.01	+.2	12	10.7	ne.	35	sw.	12	8	12	11	5.9	.0	.0	7
North Dakota							68.0	−0.5										72	2.61	0.0										5.4			
Fargo [1]	940	5	43	28.94	29.94	.00	68.8	+.7	94	17	81	43	6	56	36	62	58	71	.87	−2.6	12	9.5	w.	34	ne.	1	8	----	9	5.2	.0	.0	7
Bismarck [1]	1,677	4	41	28.20	29.96	+.03	68.6	−.8	92	16	80	43	6	57	34	62	58	73	4.17	+1.9	13	8.5	nw.	54	nw.	7	12	14	7	5.0	.0	.0	13
Devils Lake	1,478	11	44	28.40	29.95	+.02	65.8	−1.6	89	11	77	43	3	55	28	60	56	76	4.25	+1.7	13	6.7	nw.	31	nw.	29	6	12	17	6.9	.0	.0	8
Lemmon, S. Dak.	2,602	4	38	27.29	29.97	-----	68.0	-----	92	16	80	47	1	56	36	60	57	---	3.11	----	14	----	nw.	----	----	----	----	12	8	6	----	.0	.0	15
Grand Forks	832	11	71	29.05	29.94	-----	66.4	-----	91	17	79	42	6	54	35	61	57	---	2.64	----	9	----	nw.	----	----	----	----	11	13	7	----	.0	.0	8
Williston	1,878	42	50	28.00	29.94	+.02	68.6	−.3	93	16	80	46	1	57	35	60	55	68	1.14	−.8	9	6.2	se.	33	w.	12	12	13	5	4.3	.0	.0	9
Upper Mississippi Valley							76.1	+0.8										75	4.99	+1.5									14	5.0			
Minneapolis-St. Paul, Minn. [1]	919	32	61	28.97	29.94	−.01	71.4	-----	96	16	81	49	6	62	30	63	59	69	3.80	+.1	10	8.5	se.	33	w.	18	7	13	11	6.0	.0	.0	13
Springfield, Minn.	1,025	4	42	28.87	29.95	-----	72.0	-----	98	17	84	47	6	60	35	64	61	---	2.75.	----	16	----	nw.	----	----	----	6	16	9	----	.0	.0	13
La Crosse [2]	714	11	48	29.20	29.96	.00	71.4	−1.4	95	17	81	51	2	62	29	65	62	77	4.12	+.2	12	4.1	w.	14	sw.	18	8	10	13	6.3	.0	.0	14
Madison [2]	974	70	78	28.96	29.99	+.02	71.8	−.3	92	17	80	55	2	63	25	65	61	73	3.79	−.1	12	6.6	nw.	24	nw.	13	9	12	10	5.8	.0	.0	11
Charles City	1,015	10	51	28.91	29.98	+.02	72.0	−.3	95	17	82	50	2	62	31	66	63	78	7.47	+3.7	12	5.4	se.	30	sw.	18	10	13	8	4.9	.0	.0	15
Davenport [2]	606	66	161	29.34	29.99	+.02	77.0	+1.7	96	17	86	55	2	68	24	68	65	73	6.15	+2.8	13	8.0	sw.	51	nw.	5	11	13	7	5.0	.0	.0	15
Des Moines [2]	860	5	99	29.05	29.96	.00	76.1	+.7	97	17	86	55	2	66	28	68	65	77	7.11	+3.6	13	8.2	s.	33	sw.	2	12	17	2	4.3	.0	.0	13
Dubuque	699	60	79	29.24	29.97	.00	74.5	+.4	95	17	84	52	2	65	27	67	64	73	3.70	−.2	11	5.0	nw.	16	nw.	13	7	14	10	5.4	.0	.0	12
Burlington, Ia.	702	6	35	29.24	29.98	.00	76.2	−.3	96	17	86	50	2	66	30	69	65	77	4.30	+.7	13	7.1	s.	24	s.	12	12	13	6	4.7	.0	.0	16
Cairo	358	87	93	29.65	30.02	+.02	82.5	+2.9	98	16	92	65	24	73	25	----	----	----	.62	−2.4	9	6.8	sw.	30	n.	21	8	15	8	5.5	.0	.0	11
Peoria [2]	609	11	45	29.36	30.00	+.02	76.3	+.9	97	17	86	51	2	66	28	69	66	78	3.88	+.3	13	3.9	sw.	21	n.	13	20	10	1	2.9	.0	.0	12
Springfield, Ill. [2]	636	5	191	29.33	30.00	+.02	78.8	+2.3	98	17	88	58	2	70	24	70	68	79	7.06	+4.2	11	9.2	s.	29	n.	13	10	11	10	5.7	.0	.0	12
St. Louis [2]	568	179	303	29.41	30.00	+.01	80.6	+1.8	97	30	89	66	8	72	26	71	67	67	7.92	+4.9	11	10.3	sw.	35	sw.	4	16	12	3	4.0	.0	.0	10
Missouri Valley							77.6	+2.2										69	3.21	−0.5										4.4			
Columbia, Mo. [2]	784	6	66	29.17	29.99	+.01	79.2	+2.3	99	31	89	60	1	69	25	71	69	75	4.63	+1.1	11	6.0	sw.	27	nw.	19	12	17	2	4.2	.0	.0	10
Kansas City [1]	963	38	76	28.96	29.96	−.01	81.5	-----	100	31	91	59	23	72	28	71	67	66	2.69	−1.4	5	10.5	sw.	30	nw.	25	14	15	2	3.8	.0	.0	8
St. Joseph [2]	967	11	49	28.96	29.96	-----	80.0	+2.6	98	29	90	58	23	70	32	71	68	75	2.21	−1.6	8	7.6	s.	21	se.	14	18	10	3	3.7	.0	.0	10
Springfield, Mo. [1]	1,324	5	60	28.66	30.02	+.04	77.2	-----	95	16	88	59	23	67	27	70	67	75	2.96	−1.2	4	9.1	sw.	40	n.	9	12	13	6	4.5	.0	.0	7
Topeka	987	65	87	28.93	29.95	-----	82.1	+4.3	104	31	93	60	23	71	28	70	66	64	1.92	−2.4	7	8.4	s.	26	n.	9	13	15	3	4.5	.0	.0	9
Lincoln [2]	1,189	11	81	28.69	29.92	−.03	79.8	+3.3	102	16	92	56	22	67	36	68	64	65	3.29	−.6	6	8.4	s.	29	s.	7	14	15	2	3.9	.0	.0	6
Omaha [1]	1,105	31	44	28.80	29.95	.00	78.0	+2.8	100	15	89	55	2	67	33	69	65	70	4.49	+1.0	11	9.8	s.	44	nw.	23	10	14	7	4.6	.0	.0	12
Valentine	2,598	46	54	27.30	29.96	+.03	73.8	+.1	101	16	88	50	2	60	37	62	56	61	3.05	.0	11	7.7	n.	30	w.	27	11	18	2	4.5	.0	.0	16
Sioux City [1]	1,138	5	27	28.75	29.94	−.01	76.0	+1.7	105	17	88	50	2	64	38	67	62	68	1.66	-----	11	7.6	se.	30	w.	29	9	15	7	4.8	.0	.0	13
Huron [1]	1,301	5	41	28.58	29.95	+.01	71.7	−.1	101	16	84	46	6	60	32	64	61	74	3.67	+.5	11	9.7	n.	46	ne.	27	9	16	6	5.0	.0	.0	13
Northern Slope							71.0	+2.0										56	1.25	−0.4										3.6			
Billings [1]	3,570	18	39	26.36	29.95	-----	72.2	+.2	99	22	86	52	13	58	40	58	49	53	.56	−.8	6	9.8	sw.	43	nw.	29	16	14	1	3.8	.0	.0	12
Havre	2,507	11	67	27.38	29.97	+.06	69.6	+1.3	97	22	84	41	13	56	43	57	48	54	2.08	+.2	11	8.1	nw.	31	nw.	12	17	11	3	3.2	.0	.0	10
Helena [1]	4,124	5	35	25.87	29.98	+.05	68.4	+2.7	96	22	84	44	18	52	46	54	45	51	.48	−.7	10	9.0	w.	54	sw.	10	15	15	1	3.3	.0	.0	15
Missoula [2]	3,205	80	91	26.68	29.99	-----	70.2	+2.6	97	7	86	44	18	54	41	56	46	54	.55	−.4	8	6.7	se.	27	ne.	10	21	9	1	2.7	.0	.0	8
Kalispell	2,973	48	56	26.96	29.96	+.03	65.6	+1.5	89	22	78	43	12	53	35	55	48	62	2.72	+.6	14	6.2	w.	25	sw.	4	15	11	5	3.7	.0	.0	13
Miles City [2]	2,371	48	55	27.50	29.94	+.02	73.0	+.1	98	22	86	52	20	60	40	61	54	59	1.44	−.1	9	5.3	ne.	41	nw.	29	19	9	3	3.3	.0	.0	6
Rapid City [2]	3,259	50	58	26.67	29.96	+.03	72.0	+1.0	94	15	84	50	2	60	40	60	54	62	1.69	−.7	13	7.4	n.	48	sw.	31	11	18	2	4.2	.0	.0	14
Cheyenne [1]	6,094	5	39	24.14	29.99	+.07	69.0	-----	94	14	85	44	21	53	39	54	48	59	1.07	−1.0	15	8.8	nw.	35	nw.	5	9	17	5	4.7	.0	.0	17
Lander	5,352	60	68	24.76	29.95	+.03	71.2	+3.8	94	22	88	50	2	55	42	54	43	45	.28	−.4	4	5.5	sw.	30	nw.	29	16	14	1	3.8	.0	.0	10
Sheridan [2]	3,790	6	42	26.16	29.95	-----	71.3	+2.9	98	22	87	48	21	56	43	57	49	54	1.09	−.1	9	6.9	nw.	45	nw.	29	10	18	3	4.3	.0	.0	18
North Platte [2]	2,821	11	51	27.07	29.92	−.01	76.6	+3.7	101	16	90	53	1	63	38	64	59	63	1.82	−.9	6	6.4	s.	23	ne.	28	21	10	0	2.5	.0	.0	9

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer temperature of the dewpoint	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Number of days with thunderstorms
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F*		°*F*	°*F*		°*F*	°*F*	°*F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*	
Middle Slope							**78.8**	**+1.8**									**57**	**1.41**	**−1.4**										**3.8**			
Denver [1]	5,292	106	113	24.85	29.97	+.06	73.3	+2.1	95	12	86	52	2	60	37	56	47	50	1.21	−.5	10	7.3	s.	32	n.	23	11	16	4	4.2	.0	.0	13
Pueblo [1]	4,690	5	36	25.38	29.96	+.05	74.4	+.2	99	13	90	50	2	59	42	58	50	54	1.10	−.8	7	8.2	w.	41	w.	29	13	17	1	3.8	.0	.0	13
Concordia	1,392	50	58	28.50	29.94	−.01	81.2	+3.2	102	31	93	60	22	69	35	68	62	58	1.53	−2.2	9	7.5	s.	31	w.	25	14	15	2	3.7	.0	.0	11
Dodge City [1]	2,509	10	86	27.40	29.92	−.01	81.0	+2.6	104	8	95	59	2	67	35	65	57	52	1.70	−1.4	7	13.9	s.	34	nw.	21	11	15	5	4.5	.0	.0	12
Wichita [1]	1,358	6	64	28.56	29.96	.00	80.8	+1.4	101	30	92	63	23	69	29	69	65	66	2.34	−1.0	4	13.7	s.	31	s.	12	15	13	3	3.7	.0	.0	6
Oklahoma City [2]	1,214	10	47	28.74	29.98	+.02	82.0	+1.4	99	29	73	64	22	71	35	70	65	63	.60	−2.3	2	8.8	s.	19	s.	12	22	5	4	2.9	.0	.0	5
Southern Slope							**81.2**	**0.0**									**56**	**0.77**	**−1.6**										**3.9**			
Abilene [3]	1,738	10	56	28.22	29.97	+.04	83.0	+.2	100	24	94	64	23	72	32	69	64	61	.19	−1.9	2	10.1	s.	21	s.	12	19	11	1	3.4	.0	.0	2
Amarillo [2]	3,676	10	49	26.34	29.95	+.03	78.6	+1.8	99	9	92	55	22	65	35	63	56	55	.80	−2.0	4	13.5	s.	32	sw.	30	17	12	2	3.4	.0	.0	10
Del Rio	960	63	71	28.98	29.94	+.04	84.0	−2.3	99	24	94	69	6	75	25	72	67	60	.13	−2.3	1	10.9	se.	32	e.	4	7	19	5	5.5	.0	.0	6
Roswell	3,566	75	85	26.42	29.94	+.06	79.0	+.1	100	12	93	58	2	65	37	64	56	52	1.96	−.3	9	7.7	s.	37	nw.	24	20	8	3	3.3	.0	.0	15
Southern Plateau							**86.1**	**+2.8**									**38**	**0.48**	**−0.7**										**2.7**			
El Paso [2]	3,778	82	101	26.21	29.88	+.04	83.6	+2.5	102	10	96	63	2	72	33	63	51	42	.68	−1.3	5	7.5	e.	27	n.	24	13	15	3	4.2	.0	.0	9
Albuquerque [1]	5,314	5	45	24.83	29.88	.....	78.8	+2.1	100	12	93	55	2	64	35	58	45	38	.20	−1.2	8	9.7	se.	43	e.	25	19	11	1	3.6	.0	.0	18
Phoenix [2]	1,107	39	87	28.68	29.78	.00	92.7	+2.9	116	6	106	70	15	79	35	69	57	37	1.24	+.2	4	6.2	e.	30	ne.	2	19	10	2	2.8	.0	.0	7
Tucson [1]	2,555	5	23	27.31	29.82	.....	89.8	.....	110	7	104	70	24	76	36	66	54	36	.68	−1.6	9	.....	s.	.....	.....	.....	14	14	3	4.2	.0	.0	13
Yuma	142	9	54	29.64	29.78	+.02	94.2	+3.3	117	7	110	73	19	78	40	72	61	30	.08	−.1	1	5.9	sw.	18	se.	14	29	2	0	0.8	.0	.0	0
Independence	3,957	5	26	25.97	29.91	+.08	81.2	+3.1	102	23	98	57	18	65	40	56	36	...	.00	−.1	0	3.6	s.	.....	.....	.....	24	7	0	0.7	.0	.0	2
Middle Plateau							**75.7**	**+3.1**									**36**	**040**	**−0.2**										**2.2**			
Reno [2]	4,527	61	76	25.51	29.96	+.09	73.3	+3.2	99	23	90	46	12	56	40	53	41	47	T	−.2	0	6.3	w.	22	w.	14	29	2	0	1.0	.0	.0	2
Tonopah	6,090	9	20	24.13	29.90	.....	78.2	.....	99	23	91	60	18	66	30	52	31	...	T	.....	0	.....	se.	.....	.....	.....	20	11	0	.....	.0	.0	1
Winnemucca	4,339	5	56	25.64	29.90	.00	75.2	+4.6	101	21	94	45	12	56	46	53	34	27	.06	−.2	1	7.6	sw.	26	sw.	22	27	4	0	1.5	.0	.0	2
Modena	5,473	10	46	.....	29.87	+.01	72.6	+2.0	97	6	91	47	18	54	.....	.....	.....	...	.42	−.7	8	10.0	sw.	34	n.	28	14	13	4	.....	.0	.0	14
Salt Lake City [1]	4,227	86	47	25.63	29.87	−.03	78.2	+4.2	101	22	94	55	2	63	42	58	44	36	.37	−.2	4	9.8	se.	39	sw.	7	23	6	2	3.1	.0	.0	10
Grand Junction	4,602	60	68	25.44	29.94	+.05	79.4	+1.7	101	13	94	59	19	65	38	57	43	35	1.15	+.5	5	6.6	se.	28	s.	14	17	11	3	3.4	.0	.0	11
Northern Plateau							**72.9**	**+2.9**									**45**	**0.35**	**−0.2**										**2.7**			
Baker [2]	3,471	36	54	26.48	29.98	+.03	67.8	+2.2	99	21	85	44	18	51	46	54	47	61	.37	−.2	4	6.1	n.	20	sw.	14	25	6	0	2.1	.0	.0	3
Boise [1]	2,739	5	49	27.13	29.90	−.03	75.7	.....	104	21	92	45	18	60	40	57	43	36	T	.....	0	9.0	nw.	31	se.	14	26	4	1	1.9	.0	.0	0
Pocatello [1]	4,478	5	31	25.51	29.91	−.01	73.0	.....	101	22	92	46	21	54	48	53	37	35	.13	−.6	1	9.2	sw.	34	w.	15	19	11	1	2.8	.0	.0	7
Spokane [1]	1,929	27	42	27.96	29.95	−.01	71.2	+2.2	98	2	86	46	12	57	40	58	49	54	.34	−.4	5	7.2	n.	27	w.	29	16	9	6	3.7	.0	.0	5
Walla Walla	991	57	65	28.90	29.94	−.03	76.9	+2.9	106	3	90	54	12	64	39	...	.....	...	.83	+.4	5	5.9	s.	23	w.	4	23	4	4	2.2	.0	.0	1
Yakima	1,076	58	67	28.82	29.95	.....	75.6	+4.2	105	3	90	46	12	61	36	58	46	41	.08	−.2	1	6.8	nw.	25	sw.	3	21	5	5	3.5	.0	.0	0
North Pacific Coast Region							**67.2**	**+3.7**									**71**	**1.10**	**+0.4**										**5.4**			
North Head	211	5	56	29.84	30.06	−.02	61.9	+4.7	87	1	66	53	24	57	23	59	57	86	1.40	+.4	13	12.4	n.	34	n.	23	4	7	20	7.4	.0	.0	0
Seattle [2]	125	90	321	29.90	30.03	−.01	67.7	+4.6	98	1	76	55	31	59	34	61	56	71	.57	−.1	5	8.7	s.	31	sw.	4	8	13	10	5.4	.0	.0	1
Tacoma	194	172	201	29.85	30.05	−.01	66.8	+4.0	93	1	75	53	12	58	29	...	.....	...	1.12	+.5	6	7.9	sw.	32	w.	4	7	12	12	6.1	.0	.0	1
Tatoosh Island	86	9	61	29.96	30.05	.00	59.0	+3.9	80	20	64	51	25	55	25	56	54	86	3.47	+1.9	11	10.9	s.	37	sw.	3	3	8	20	6.5	.0	.0	0
Medford [1]	1,329	29	58	28.60	29.97	.....	73.2	+1.5	108	1	89	46	11	57	45	59	50	51	T	−.4	0	.....	nw.	.....	.....	.....	24	3	4	2.2	.0	.0	0
Portland, Oreg. [3]	154	68	106	29.86	30.03	−.02	71.0	+4.3	107	2	81	53	12	61	36	62	58	70	.96	+.4	5	5.6	nw.	18	w.	10	12	9	10	5.2	.0	.0	0
Roseburg	510	45	76	29.49	30.03	.00	70.6	+3.2	106	1	84	50	12	58	42	61	54	63	.16	−.2	2	4.4	n.	16	n.	25	14	13	4	3.9	.0	.0	0
Middle Pacific Coast Region							**69.7**	**+2.4**									**64**	**0.02**	**0.0**										**3.4**			
Eureka	60	72	88	30.00	30.07	+.02	59.8	+4.3	71	1	64	53	13	56	15	57	55	86	.07	.0	5	6.9	n.	19	n.	11	4	11	16	6.7	.0	.0	0
Redding [1]	722	20	34	29.14	29.90	.....	82.9	+1.1	111	24	96	61	16	70	32	62	46	32	.00	−.1	0	8.0	nw.	28	nw.	10	29	2	0	1.2	.0	.0	0
Sacramento [2]	66	92	115	29.83	29.90	+.02	76.3	+3.1	108	24	93	55	31	60	43	62	53	53	T	.0	0	7.8	s.	24	sw.	4	29	2	0	.8	.0	.0	0
San Francisco	155	112	132	29.81	29.98	+.03	59.7	+1.2	70	9	65	51	1	55	16	56	54	85	.01	.0	1	11.2	w.	29	w.	10	7	20	4	4.9	.0	.0	0
South Pacific Coast Region							**74.9**	**+2.0**									**61**	**T**	**0.0**										**2.4**			
Fresno [1]	327	5	35	29.53	29.87	+.04	83.4	+2.1	111	1	101	60	5	66	40	64	51	38	T	.0	0	7.7	nw.	20	nw.	10	29	2	0	.7	.0	.0	0
Los Angeles	338	223	250	29.59	29.94	+.04	71.8	+1.6	90	7	82	58	31	61	27	62	58	70	.00	.0	0	5.7	w.	17	w.	21	25	6	0	2.6	.0	.0	0
San Diego [1]	87	20	55	29.85	29.95	+.03	69.6	+2.4	84	8	76	58	5	63	24	63	60	76	.00	.0	0	6.8	w.	19	s.	9	14	16	1	4.0	.0	.0	0
West Indies																																
San Juan, P. R.	82	10	54	29.94	30.02	.....	80.7	+.6	92	21	85	70	8	76	15	77	75	81	7.45	+1.5	23	13.6	e.	31	e.	28	0	2	10	6.5	.0	.0	8
Panama Canal																																
Balboa Heights	118	6	92	.....	[4]29.85	+.02	81.0	+.7	91	17	88	72	13	74	17	...	.....	[5]88	6.22	−.9	20	4.9	nw.	19	nw.	26	0	8	23	7.9	.0	.0	10
Cristobal	27	47	97	.....	[4]29.86	+.01	81.6	+1.2	89	17	86	73	3	77	15	77	76	[5]87	17.35	+1.7	28	7.1	w.	24	sw.	3	0	2	29	9.0	.0	.0	12
Alaska																																
Juneau	80	96	116	.....	[4]30.06	.....	57.7	+1.0	80	29	64	45	3	51	...	...	...	...	6.16	+1.0	17	5.1	s.	19	w.	30	3	5	23	.....	.0	.0	0
Nome	22	25	56	.....	[4]29.88	.....	48.6	−1.3	66	22	53	35	19	44	...	...	...	88	4.08	+1.5	17	9.9	s.	35	sw.	24	1	5	25	.....	.0	.0	0
Hawaiian Islands																																
Honolulu	38	86	100	29.97	30.01	.....	78.4	+.7	85	18	83	71	17	74	13	70	67	72	.29	−.9	7	8.9	ne.	23	ne.	11	5	14	12	6.4	.0	.0	1

[1] Data are airport records.
[2] Barometric data (adjusted to old city elevation) and hygrometric data from airport; otherwise city office records.
[3] Observations taken hourly.
[4] Pressure not reduced to a mean of 24 hours.
[5] Barometric data from airport; other data from city office records.
[6] Wind, clear, partly cloudy, and cloudy data from city office records; other data from airport.

NOTE.—Except as indicated by notes 1, 2, 5 and 6 data in table are *city office* records.

SEVERE LOCAL STORMS, JULY 1942

(Compiled by Mary O. Souder)

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Laurens County, S. C	1	P. m.			$5,150	Electrical	2 barns including livestock and feed burned.
Russell, Kans., 4 miles south	2	7 p. m.	[1] 1		10,000	Hail	Chief loss in unharvested wheat; path 4 miles long.
Menno, S. Dak., and vicinity	2	8:30–8:40 p. m.			30,000	Heavy hail	50 to 100 percent loss in grains and gardens; some corn badly stripped; path narrow.
Carroll, Audubon, Guthrie, Adair, Madison, Clarke, and Union Counties, Iowa.	2–3	10:30 p. m.–2 a. m.	[1] 7		40 000	Hail, rain, and flood	Property damage, $4,000; loss in crops, $36,000.
Richland County, Mont	4	5–7 p. m.	[1] 12		5,000	Hail	Loss in crops; path 10 miles long.
Luverne, Iowa	5	7 p. m.			1,500	do	Path 2 miles long.
Tama County, Iowa	5	8:30 p. m.			6,000	do	Property damaged.
Davenport, Iowa, and vicinity.	5	10:45 p. m.		0	50,000	Tornado and hail	Loss in crops; property damaged.
Hutchins, Goodel, and Belmond, Iowa.	5		880	0	50,000	do	Property damage and loss in crops.
Plainview, Tex., vicinity of	6	8:45 p. m.	[1] 1		15,000	Heavy hail	Loss in cotton, vegetables, and feed crops.
Broadheadsville, Pa., and vicinity.	6	P. m.			15,000	Wind and hail	Trees blown down; utilities disrupted; other property damaged.
Wilkes-Barre, Pa., and vicinity.	6	do			350,000	Hail, wind, and rain	Much crop loss and property damage.
Hewittville, N. Y	6				1,000	Electrical	Lighting struck a hydroelectric station with damage to generators.
Richfield, N. Y	6				2,000	do	Barn burned.
Daniels and Sheridan Counties, Mont.	7	4 p. m.	880		2,000	Hail	Loss in crops.
Sheridan and Roosevelt Counties, Iowa.	7	6–7 p. m.	[1] 5		150,000	Heavy hail	Storm occurred north and east of Froid in the Medicine Lake area, moving into Williams County, N. Dak. Crop loss, $150,000; considerable property damaged; path 15 miles long.
Sheridan County, Mont	8	3–4:30 p. m.	[1] 6		850,000	do	Principal loss in wheat, flax, and small grains. Crop loss, $850,000; property damage considerable but not estimated. Path 30 miles long.
Geraldine, Mont., vicinity of	8	3:30 p. m.	[1] 4		5,000	Hail	Loss in wheat and grass; path 8 miles long.
Dillon County, S. C	8	5 p. m.			5,000	do	Loss in cotton and tobacco.
Dillon, S. C	8	5:15 p. m.			1,000	Thundersquall	Roof and awnings damaged.
Carlyle, Mont	8	9 p. m.	[1] 4		75,000	Heavy hail	Principal loss in grain; path 6 miles long.
Columbia, S. C	8				20,000	Thundersquall	15 small aircraft on municipal airport field damaged or destroyed and barn blown down.
Pound, Va	8				151,000	Rain and flood	Damage to bridges, $5,000; crop loss $46,000; loss in livestock and damage to buildings, $100,000.
Dumas, Tex., vicinity of	9–10		2,640		20,000	Heavy hail	Loss principally in wheat; path 20 miles long.
Idaho County, Idaho	10	6 p. m.	[1] 4			do	30 to 40 percent loss in grains and gardens, not estimated; path 20 miles long.
Princeton and Isanti, Minn., and vicinities.	12	5:45 p. m.	[1] 1		120,000	Thundersqualls	Property damaged, $109,000; crop loss, $11,000. Storm moved from northwest to southeast over a path about 20 miles long.
Lyon County, Iowa	14	2:45 p. m.	[1] 1		15,000	Hail	Loss in crops; path 18 miles long.
Marlboro County, S. C	14	7 p. m.			5,000	Electrical	Residence burned.
Albert Lea, Minn., and vicinity.	15	3:30 a. m.	[1] 2		56,000	Hail	Storm moved from southwest to northeast over a path about 5 miles long; loss to growing crops, $50,000; property damage, $6,000.
Wadena, Minn	15	4 a. m.	[1] 2		10,000	do	Storm moved from northwest to southeast over a path about 4½ miles long. Loss principally to growing crops; several windows broken in farmhouses about 9 miles northeast of Wadena.
Minneapolis, Minn	15	5:20 a. m.			25,000	Electrical	Shed and warehouse destroyed.
Blythe, Calif., vicinity of	15	7 p. m.	2,640			Straight-line wind	Storm moved north over a path at least 8 miles long. At a small airport, 14 miles west of Blythe, 26 light trainer planes were badly damaged and 1½ miles of high-tension power lines about 8 miles south-southeast of the airport.
New York State, southwestern portion.	17–18			5		Electrical, heavy rain, and flood.	The heavy rainfall in Cattaraugus and Allegany Counties and vicinities, caused floods in the Allegheny River Basin, especially in Olean, Porterville, and Salamanca. 4 persons drowned; thousands homeless; much property damage. 1 person killed by lightning at Lyndonville.
Hickok, Kans	18	6:30 p. m.	440	0	150	Tornado	Garage, lumber shed, and a store damaged; path 4 miles long.
Calhoun County, Iowa	18	8 p. m.	167	0	1,000	do	Rain accompanied the tornado; 3 farms damaged.
Elk, McKean, and Potter Counties, Pa.	18			12		Heavy rain, electrical.	Excessive rains caused rivers to rise resulting in floods causing millions of dollars damage. Bridge and highways washed out; railroads blocked by water slides; thousands homeless, area cut off; some loss due to fires.
LaMesa, N. Mex	20	P. m.			30,000	Hail	Loss in crops.
Honea Path, S. C	22	5 p. m.	[1] 2½		25,000	Tornadic wind	Property damaged; path 4 miles long.
Haygood, S. C	22				2,000	Electrical	Gin house and 2 gins destroyed by fire.
Roswell, N. Mex	24	2:38–2:45 p. m.	[1] 2		32,000	Hail	Cotton complete loss with leaves and bolls knocked off.
Teton County, Mont	24	8:30 p. m.	[1] 2		100,000	Hail and wind	Loss in crops; path 40 miles long.
Luverne, Minn., and vicinity	24	P. m.			25,000	Thunder storm and hail.	Loss in growing crops.
Sabetha, Kans., vicinity of	24	do	[1] 3		10,000	Heavy hail	Loss mostly in crops.
Hokah County, Minn	25	5 p. m.	[1] 2		10,200	Thunder storm and hail.	Loss to growing crops, principally corn and small grain; path 3 miles long.
Winifred, Mont., vicinity of	25	8:30 p. m.	[1] 2		50,000	Heavy hail	Loss in crops; path 35 miles long.
Lancaster County, Pa	26	P. m.		2	21,500	Thunderstorm	Heavy rain caused flash floods; 2 persons drowned. Several fires caused damage to lightning.
Dallas County, Iowa	27	3–4 p. m.			4,200	Heavy rain and hail	Crop loss, $1,000; damage from flooding, $3,200.
Philadelphia, Pa	27				40,000	Heavy rain	Streets flooded; traffic blocked; property damaged.
Waukau, Wis	28	4 p. m.	440	0	10,000	Tornado	Storm moved from west to east through the village; 1 person injured; many trees uprooted; property damaged; path 880 yards long.
Hancock, Wis., vicinity of	28			0		do	Damage to buildings; no details.
Heuvelton, N. Y., vicinity of	28					Electrical	Large barn with 100 tons of hay and some equipment burned.
Lycoming County, Pa	28				10,000	do	2 barns burned.
Hill County, Mont	28–30	5–6 p. m.	[1] 4		400,000	Severe hail	Loss in crops, about 20,000 acres, including scattered hailstorms in vicinity of Havre, July 29 and 30, total loss about 700,000 bushels grain. Property damage considerable, but not estimated.
Benson, Minn., and vicinity	30	2–6 a. m.			5,000	Heavy rain	Heavy to excessive rains caused much lodging of grain and corn and flooding of lowlands.
Black Hawk County, Iowa	30	A. m.			90,000	Heavy rain, electrical.	6 residences and a church damaged by fire; 10 county bridges washed out; streets damaged and basements flooded.
Luverne, Minn., and vicinity	30	do				Rain and flood	Heavy to excessive rains between the 25th to 30th resulted in high water in Rock River and Beaver Creek causing them to overflow. Highways, roads and lowlands inundated, about 2,790 feet of railroad track washed out, thousands of shocks of grain floated away and lowland were forced to move livestock to higher ground. Sewers overflowed and basements flooded and there was much damage from washing of crops and erosion.

Footnote at end of table.

SEVERE LOCAL STORMS, JULY 1942—Continued

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Chouteau County, Mont.	30	6–7 p. m.	[1] 5		1,500,000	Hail	Loss in wheat; path 60 miles long.
Custer County, Mont.	30	P. m.	[1] 1		25,000	do	Loss in crops; path 10 miles long.
Teton County, Mont.	30		[1] 2½		100,000	do	Loss in crops; path 40 miles long.
Wibaux County, Mont.	31	7–7:30 p. m.	[1] 6		200,000	do	Loss in crops.
Fallon County, Mont.	31	8:30–9:30 p. m.	[1] 5		80,000	Heavy hail	Do.
Chouteau County, Mont.	31	P. m.	[1] 5		25,000	Hail	Loss in crops over a path 10 miles long.
Allen County, Ind.	31				5,000	Wind and hail	Trees and buildings damaged; some loss from flooding.

LATE REPORTS FOR JUNE 1942

Hinckley, Minn.	5	6 p. m.	[1] 5		10,000	Thunderstorm and hail.	Crop loss, $5,000; property damage, $5,000.
Watts, Okla., vicinity of	12	11 a. m.			1,700	Wind	Large barn under construction destroyed and many trees blown down.
Anderson, S. C., and vicinity.	13	3:45 p. m.			5,000	Thundersquall	Loss in unharvested wheat in the Mountain Creek area; 2 mules killed by falling timber when 2 barns blew down.
Manning, S. C.	13	P. m.			2,000	do	Communication lines, trees, and outbuildings blown down.
Hoisington, Kans., and vicinity.	18	do			75,000	Hail and wind	Wind damage general and especially severe in Hoisington. Greater part of damage from hail. Loss in wheat 70 percent.
Blackwell, Okla., and vicinity.	20–21	11:50 p. m.–12:30 a. m., C. S. T.	[1] 2		2,000	Hail and rain	Property damaged; loss in fruit not given in estimate.

[1] Miles instead of yards.

SOLAR RADIATION AND SUNSPOT DATA FOR JUNE AND JULY 1942

[Solar Radiation Investigations Section, I. F. HAND in charge]

SOLAR RADIATION OBSERVATIONS

Explanations of the tables, and references to descriptions of instruments, stations and methods of observation, and to summaries of data, are given in the January 1942 REVIEW, p. 20.

Beginning with this issue, total solar and sky radiation data from East Wareham, Mass., will appear in table 2 through a cooperative arrangement between the Weather Bureau and Dr. H. F. Bergman of the Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture. The pyrheliometric equipment, of which he has supervision, is used in research studies that include the photosynthesis which takes place in cranberry bushes beneath varying thicknesses and qualities of snow cover.

The coordinates of this station are as follows: Lat. 41°45′01″ N., longitude, 70°40′08″ W., altitude, 50 feet. East Wareham is near the neck of Cape Cod in the midst of an extensive cranberry bog section. Owing to its proximity to the ocean the immediate area is subject to considerable fog.

TABLE 1.—*Solar radiation intensities during June 1942*

[Gram-calories per minute per square centimeter of normal surface]

Madison, Wis.

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air Mass: A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
June 8	8.81				0.84	1.35					10.21
June 12	14.60	0.65	0.74	0.90	1.03						14.10
June 16	7.87			.69	1.01	1.35					9.47
June 21	12.24	.71	.83	.98	1.15	1.36					9.14
June 24	9.47	.74	.86	.99	1.15	1.34					8.48
June 30	14.10	.76	.84	.98	1.13	1.32					12.68
Means		.72	.82	.91	1.05	1.34					
Departures		+.04	0	−.04	0	+.01					

Lincoln, Nebr.

June 13	7.87					1.39	1.17				6.50
June 23	9.83					1.35					10.97
Means						(1.37)	(1.17)				
Departures						(+.01)	(+.07)				

TABLE 1.—*Solar radiation intensities during June 1942*—Continued

[Gram-calories per minute per square centimeter of normal surface]

Albuquerque, N. Mex.

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air Mass: A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
June 1	3.45	0.92	1.01	1.14	1.25	1.49	1.30	1.14	0.99	0.92	7.87
June 5	7.04	.88	0.94	1.07	1.22	1.44	1.30	1.10			5.16
June 6	4.75	.90	.99	1.11	1.26		1.27	1.13	.95	.89	4.17
June 7	7.87			1.00	1.18	1.42					7.04
June 8	7.87				1.18		1.20				7.29
June 9	3.30	.89	.96	1.09	1.24	1.45					4.57
June 11	4.57					1.50					4.95
June 12	3.45	.97	1.06	1.18	1.32	1.50	1.32	1.19	1.07	1.01	4.17
June 13	6.02					1.44	1.17				7.87
June 16	3.63					1.44					4.75
June 18	4.75							1.16	1.02	.96	6.50
June 19	4.57	.95	1.04	1.15	1.31	1.51	1.30	1.15			5.16
June 20	3.00		1.11	1.19	1.35	1.52	1.31	1.20	1.06	1.00	4.17
June 21	3.15	1.00	1.08	1.19	1.33	1.50	1.29				4.57
June 22	4.75		1.01	1.08		1.37	1.10	0.91			10.57
June 23	10.97		.75	0.90	1.11	1.35	1.08		.77	.68	7.04
June 24	7.57		.95	1.05	1.19	1.44					3.33
June 25	3.81	.96	1.02	1.16	1.27						4.95
June 26	4.57	.89	.97	1.10	1.27	1.45					4.57
June 27	3.81		.96	1.08	1.20	1.43	1.20	1.03	.90	.83	4.57
June 28	3.15		1.06	1.18	1.32	1.51	1.29	1.16	1.02	.95	3.45
June 29	2.26	.92	.99	1.11	1.27		1.31	1.13			3.45
Means		.93	.99	1.10	1.25	1.46	1.25	1.12	.97	.90	
Departures		+.03	+.01	+.02	+.02	+.01	+.01	+.02	0	−.01	

Blue Hill, Mass.

June 5	16.3							0.84	0.66	0.55	13.1
June 6	16.3	0.81	0.84					.54			15.7
June 8	19.5					1.24	0.93	.68	.53	.40	15.7
June 9	14.6	.57	.63				.62	.41	.27	.18	13.6
June 10	11.3					1.12	.97				18.7
June 12	24.0				1.01						25.6
June 18	11.3						1.02	.79	.63		14.1
June 19	12.3				.85		.84	.56	.39	.27	14.6
June 20	18.8				.93		.85	.57	.37	.28	16.3
June 24	13.1					1.36	1.08	.81	.63	.49	13.1
June 25	12.6						1.02	.85	.65	.56	14.1
June 26	14.1	.82	.91	1.01	1.15						14.1
June 27	15.7					1.07	.63				17.5
June 30	18.8						.81				17.5
Means		.73	.79	(1.01)	.99	1.20	.88	.67	.52	.39	
Departures		+.05	0	(+.07)	−.06	−.10	−.16	−.19	−.10	−.06	

*Extrapolated.

TABLE 2.—*Daily totals and weekly means of solar radiation (direct and diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

Date	Washington	Madison	Lincoln	Chicago	New York	Fresno	Fairbanks	Nashville	Twin Falls	New Orleans	Riverside	Blue Hill	Friday Harbor	Ithaca	Newport	State College	Put in Bay	San Juan u. v. below 3132 Å	East Wareham
1942	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*millical.*	*cal.*
June 4	500	463	680	587	104	707	.....	561	714	14	677	215	819	407	399	469	633	164	324
June 5	713	598	522	597	708	718	.....	614	692	309	598	496	662	771	597	812	717	189	416
June 6	644	507	510	553	583	751	.....	594	632	242	577	542	174	704	716	728	517	66	693
June 7	618	138	552	182	472	742	.....	671	513	.....	465	277	320	239	522	387	88	142	424
June 8	282	703	252	449	441	729	.....	466	675	.....	609	521	262	776	402	569	683	202	414
June 9	290	613	354	529	685	746	.....	348	662	250	536	618	271	715	703	587	552	416	689
June 10	238	521	388	396	480	749	.....	491	760	602	544	667	282	685	779	286	501	264	707
Mean	**469**	**506**	**465**	**470**	**496**	**734**	**583**	**535**	**664**	**426**	**572**	**476**	**399**	**614**	**588**	**548**	**527**	**206**	**524**
Departure	−40	−7	−67	−6	+2	+63	+86	.....	+78	−36	+42	−45	−195	+86	+46	+58	.....	.....	.....
June 11	383	243	664	282	365	728	.....	627	705	448	568	536	589	415	621	424	577	398	607
June 12	564	561	572	481	214	744	.....	183	731	493	390	560	640	441	414	506	298	330	597
June 13	409	255	676	253	460	737	.....	330	605	522	638	542	710	338	648	393	601	149	597
June 14	615	801	618	831	113	726	.....	696	602	605	506	475	89	94	346	332	277	243	339
June 15	738	533	386	521	719	692	.....	502	407	582	419	220	473	814	281	836	671	98	305
June 16	582	566	216	685	738	766	.....	236	704	505	577	246	516	605	529	508	230	212	359
June 17	517	355	373	445	173	750	.....	543	740	459	612	108	600	99	453	128	586	450	.....
Mean	**544**	**473**	**501**	**500**	**397**	**735**	**502**	**445**	**642**	**516**	**530**	**384**	**517**	**401**	**470**	**447**	**463**	**275**	**467**
Departure	+42	−33	−28	+35	−91	+42	−2	.....	+25	+51	−40	−92	−29	−101	−112	−35	.....	.....	.....
June 18	682	565	544	393	543	755	.....	550	688	397	592	300	672	699	420	712	570	502	252
June 19	381	479	664	413	505	777	.....	572	694	198	561	595	794	604	631	648	583	263	578
June 20	615	270	503	183	657	774	.....	622	712	190	623	572	608	778	713	609	564	246	582
June 21	677	683	397	578	316	760	.....	527	744	.....	668	116	790	361	134	361	595	250	187
June 22	395	719	655	698	286	750	.....	351	731	.....	661	452	677	350	480	166	425	259	437
June 23	626	378	516	386	472	750	.....	647	733	.....	670	244	554	594	304	750	487	393	229
June 24	645	639	501	432	591	757	.....	599	680	570	684	657	556	454	686	512	653	258	711
Mean	**574**	**533**	**540**	**440**	**481**	**760**	**698**	**553**	**712**	**338**	**635**	**419**	**664**	**548**	**481**	**537**	**554**	**327**	**425**
Departure	+77	−2	−33	−58	−13	+44	+170	.....	+34	−115	+39	−127	+61	+28	−60	+20	.....	.....	.....
June 25	718	120	322	224	584	743	.....	627	179	586	683	519	591	722	714	778	602	369	659
June 26	212	208	346	168	315	748	.....	375	536	443	650	584	636	470	660	128	375	139	627
June 27	94	524	627	635	268	736	.....	568	557	508	619	561	683	685	465	109	618	170	423
June 28	436	579	322	630	486	737	.....	604	737	513	662	422	713	729	433	376	568	133	457
June 29	530	644	546	643	458	723	.....	436	734	372	654	577	771	714	578	573	588	144	530
June 30	658	697	593	722	545	718	.....	497	735	281	598	587	744	610	656	667	567	167	621
July 1	365	713	626	448	278	700	.....	316	674	.....	622	443	740	360	612	195	482	115	615
Mean	**430**	**498**	**483**	**496**	**419**	**729**	**377**	**489**	**593**	**450**	**641**	**528**	**697**	**613**	**588**	**404**	**543**	**192**	**562**
Departure	−96	−37	−104	+26	−67	+31	−79	.....	−36	+4	+60	+28	+78	+128	+25	−84	.....	.....	.....

ACCUMULATED DEPARTURES ON JULY 1, 1942

	+2219	−3661	−5523	+3080	−1288	+1631	−2317	.....	−1183	+7406	+6510	−5600	−791	−378	−2261	.....	.....	.....	.....

LATE DATA

The weekly means of total solar and sky radiation at Cambridge, Mass. for the weeks beginning June 4, 11, 18 and 25, 1942, expressed in gram-calories per square centimeter, are 512, 390, 423 and 522 with corresponding departures of +80, −58, −61 and +14.

TABLE 1.—*Solar radiation intensities during July 1942*

[Gramalories per minute per square centimeter of normal surface]

MADISON, WIS.

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass: A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
July 1	11.81			0.36	0.55	0.68					7.87
July 2	8.81	0.51	0.59	.75	.98						8.18
July 7	8.81	.47	.59	.81	.99	1.33					8.81
July 11	14.10				.88	1.09					12.24
July 17	19.23	.54	.68	.87	1.03	1.25					20.57
July 18	22.00	.38	.49	.68	.87	1.05					19.89
July 20	14.10	.71	.80	.94	1.10	1.32					11.81
July 23	10.59			.42	.60	.91					10.21
July 27	14.60	.54	.62	.73	.94	1.16					15.11
July 31	18.59	.70	.79	.91	1.13	1.39					14.10
Means		.55	.65	.72	.91	1.13					
Departures		−.10	−.11	−.17	−.15	−.16					

ALBUQUERQUE, N. MEX.

July 2	8.48	0.79	0.85	0.99	1.14	1.39					8.18
July 3	7.87			1.00	1.14	1.37					7.87
July 4	7.57	.81	.89	1.02	1.17	1.42					5.56
July 5	6.27	.81	.89	1.01	1.19	1.41	1.24				6.27
July 6	6.27	.83	.92	1.04	1.20	1.40					7.29
July 7	6.76			.94	1.09	1.33					7.29
July 8	10.21			.93	1.12	1.36					9.14
July 9	11.38	.74	.82	.95	1.13	1.35					9.14
July 10	7.87		.81	.95	1.12						8.18
July 12	7.29					1.40	1.16	1.00	.87	.80	5.36
July 13	7.29		.80	.93	1.10						8.48
July 14	8.18			.99	1.14						7.57
July 15	7.87	.80	.91	1.03	1.19	1.40					7.29
July 16	10.21					1.40					9.83
July 17	10.21	.73	.82	.94	1.12	1.37		1.01	.88		10.21
July 18	11.38	.71	.83	.96	1.14	1.42					8.48

TABLE 1.—*Solar radiation intensities during July 1942*—Continued

[Gram-calories per square centimeter of normal surface]

ALBUQUERQUE, N. MEX.—Continued

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass: A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
July 19	6.50				1.20	1.42	1.20	1.08	.95	.87	5.16
July 20	9.83	.83	.95	1.04	1.20	1.37	1.20	1.04	.92	.82	10.97
July 21	11.81	.80	.88	1.02	1.17		1.15				9.83
July 22	10.97						1.19	1.04			10.21
July 23	8.18					1.44	1.19	1.00	.89	.79	9.14
July 24	6.27	.68	.78	.92	1.11	1.36	1.08	.87	.78	.66	7.57
July 25	7.57	.71	.80	.93	1.13		1.16	.96			8.18
July 27	9.14	.69	.80	.93	1.06	1.33					8.81
July 28	9.14	.68	.77	.88	1.06	1.33					9.14
July 29	8.81					1.32					10.21
July 30	9.47					1.33	1.08				8.81
Means		.76	.85	.97	1.14	1.38	1.16	1.00	.88	.79	
Departures		−.03	−.03	−.02	−.01	−.01	−.02	−.04	−.02	−.02	

BLUE HILL, MASS.

July 9	12.6	0.69					0.79	0.65			14.6
July 10	11.3	.73	0.84								13.1
July 13	16.3	.34	.45	0.58	0.80		.71		0.37	0.27	18.2
July 15	11.7	.77	.85	.95	1.11	1.33	1.08				13.1
July 16	13.1	.71	.77	.90	1.09	1.13		.76	.62	.47	14.1
July 21	22.4					.99			.58		20.9
July 22	16.9				1.13	1.33	1.13	.93	.82		13.6
July 23	13.6						.90	.71	.56	.46	15.7
July 24	18.2	.35	.44	.64	.88						18.2
July 25	23.2						.50	.28	.19		21.6
July 26	19.5	.19	.23		.50		.50				20.9
Means		.54	.60	.77	.92	1.20	.80	.67	.53	.40	
Departures		−.05	−.07	−.09	−.12	−.06	−.19	−.16	−.04	−.20	

[1] Extrapolated.

TABLE 2.—*Daily totals and weekly means of solar radiation (direct+diffuse) received on a horizontal surface*

[Gram-calories pers square centimeter]

Date	Washington	Madison	Lincoln	Chicago	New York	Fresno	Fairbanks	Cambridge	Nashville	Twin Falls	New Orleans	Riverside	Blue Hill	Friday Harbor	Ithaca	Newport	State College	Put-in Bay	San Juan u. v. below 3132 Å	East Wareham
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*milli-cal.*	*cal.*
July 2	424	617	595	624	86	685	-------	112	583	717	-------	623	84	734	668	140	564	681	228	203
July 3	597	516	591	357	564	685	-------	286	604	722	175	645	268	699	759	443	654	493	92	344
July 4	587	521	518	401	515	720	-------	537	513	673	150	670	495	511	443	476	511	580	486	493
July 5	510	544	598	468	576	730	-------	499	475	692	258	668	457	732	545	540	520	510	423	422
July 6	503	740	643	688	408	720	-------	525	502	659	476	648	503	579	270	604	319	383	412	574
July 7	699	722	498	751	741	722	-------	720	270	527	493	633	680	615	677	770	624	728	304	722
July 8	419	565	620	517	469	744	-------	490	446	712	577	670	431	444	568	614	576	681	310	550
Mean	**534**	**604**	**580**	**544**	**480**	**715**	**442**	**453**	**485**	**672**	**355**	**651**	**417**	**616**	**562**	**513**	**538**	**579**	**320**	**472**
Departure	+22	+57	−7	+36	−30	+17	−21	−63	-------	+67	−59	+52	−139	+25	−4	−52	+38	-------	-------	-------
July 9	581	502	457	478	684	742	-------	564	293	710	704	670	581	384	747	688	709	688	392	-------
July 10	362	681	617	479	413	730	-------	596	363	573	567	684	595	384	384	612	221	340	445	661
July 11	622	659	592	670	157	756	-------	184	346	713	455	661	142	605	441	76	498	673	-------	90
July 12	658	619	631	563	681	715	-------	615	496	716	684	653	565	727	709	677	734	654	-------	-------
July 13	660	399	627	578	539	708	-------	625	526	711	441	634	612	312	693	676	625	570	370	640
July 14	640	628	628	523	519	615	-------	472	368	514	597	620	479	206	637	494	488	615	427	455
July 15	657	103	651	181	674	702	-------	655	572	601	181	640	609	344	705	709	781	659	491	657
Mean	**597**	**513**	**600**	**500**	**524**	**709**	**463**	**655**	**423**	**648**	**518**	**652**	**512**	**423**	**617**	**562**	**588**	**600**	**425**	**513**
Departure	+92	−31	−14	+5	+24	+22	−15	+18	-------	+35	+99	+70	−4	−155	+83	+30	+34	-------	-------	-------
July 16	612	633	644	641	615	711	-------	559	592	717	342	659	570	287	601	646	517	300	342	472
July 17	566	679	565	676	196	698	-------	366	590	708	508	636	350	324	358	484	407	604	424	359
July 18	358	666	360	627	378	691	-------	91	430	736	460	632	74	712	459	165	103	641	94	118
July 19	609	491	559	551	438	688	-------	436	509	720	420	659	472	711	617	360	587	565	343	379
July 20	565	689	601	601	504	698	-------	489	477	717	529	613	503	715	647	475	430	667	330	426
July 21	573	286	561	686	596	574	-------	454	198	712	344	622	493	707	576	402	673	554	232	354
July 22	500	657	639	645	657	852	-------	610	353	-------	332	583	660	625	526	718	581	436	196	-------
Mean	**540**	**586**	**561**	**632**	**482**	**673**	**509**	**429**	**450**	**718**	**390**	**629**	**446**	**583**	**541**	**464**	**471**	**538**	**280**	**369**
Departure	+56	+55	−10	+130	+11	−6	+75	−46	-------	+96	−26	+61	−40	−37	−8	−18	−81	-------	-------	-------
July 23	471	613	-------	599	594	663	-------	546	500	718	584	581	562	704	567	548	475	613	539	488
July 24	183	477	-------	455	260	641	-------	479	372	659	357	595	523	691	654	575	552	566	124	574
July 25	162	547	-------	524	398	661	-------	474	194	681	158	525	458	688	639	547	442	502	91	448
July 26	438	562	-------	563	492	670	-------	508	334	654	295	599	535	534	228	598	206	353	472	492
July 27	411	640	-------	284	80	689	-------	96	415	698	472	597	86	-------	429	153	220	529	406	183
July 28	587	251	-------	404	386	698	-------	300	417	582	445	613	327	566	484	453	504	601	235	300
July 29	535	336	-------	514	439	696	-------	283	395	660	329	641	356	459	372	599	267	486	380	364
Mean	**398**	**489**	-------	**478**	**378**	**674**	**456**	**385**	**375**	**665**	**377**	**593**	**407**	**607**	**482**	**496**	**381**	**521**	**385**	**407**
Departure	−89	−24	-------	−12	−76	+20	+37	−69	-------	+92	−30	+57	−50	+5	+3	+4	−135	-------	-------	-------
ACCUMULATED DEPARTURES ON JULY 29, 1942																				
	+2786	**−3262**	**−5544**	**+4193**	**−1785**	**+2002**	**−1785**	**−1883**	-------	**+847**	**+7294**	**+8190**	**−7231**	**−1925**	**+140**	**−2513**	-------	-------	-------	-------

POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JULY 1942

[Communicated by Capt. J. F. Hellweg, U. S. N. (Ret.), Superintendent, U. S. Naval Observatory.] All measurements and spot counts were made at the Naval Observatory from plates taken at the observatories indicated. Difference in longitude is measured from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millionths of Sun's hemisphere. For each day, under longitude, latitude, area of spot or group, and spot count, are included assumed longitude of center of the disk, assumed latitude of center of the disk, total area of spots and groups, and total spot count.

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1942	h m		°	°	°	°				
July 1	12 1	7454	−28	345	−10	31	48	8	F	Mt Wilson.
				(13)	(+3)		48	8		
July 2	10 36	7454	−14	347	−10	18	145	16	G	U. S. Naval.
				(1)	(+3)		145	16		
July 3	10 43	7454	−1	346	−10	12	145	12	F	Do.
				(347)	(+3)		145	12		
July 4	10 41	7455	−43	291	−4	44	48	10	G	Do.
		7454	+13	347	−10	17	145	18		
				(334)	(+3)		193	28		
July 5	9 45	7455	−30	291	−4	31	436	13	F	Mt. Wilson.
		7454	+27	348	−10	30	145	9		
				(321)	(+3)		581	22		
July 6	11 9	7455	−17	290	−5	19	339	8	G	U. S. Naval.
		7456	+21	328	−11	26	48	4		
		7457	+21	328	−14	27	12	1		
		7454	+40	347	−10	42	145	13		
				(307)	(+3)		544	26		
July 7	10 50	7455	−3	291	−4	9	388	15	G	Do.
		7458	+32	326	−3	33	12	2		
		7454	+52	346	−10	54	145	12		
				(294)	(+4)		545	29		
July 8	8 39	7455	+10	292	−3	13	388	18	VG	Mt. Wilson.
		7454	+65	347	−10	67	97	9		
				(282)	(+4)		485	27		
July 9	10 48	(*)	−10	258	+6	11	6	1	VG	U. S. Naval.
		7455	+24	292	−4	26	388	12		
		7454	+80	348	−10	80	24	2		
				(268)	(+4)		418	15		
July 10	11 23	7459	+3	257	+8	6	12	3	G	U. S. Naval.
		7455	+37	291	−4	39	339	11		
				(254)	(+4)		351	14		
July 11	10 35	7459	+10	251	+7	11	12	2	G	Do.
		7455	+50	291	−4	51	339	10		
				(241)	(+4)		351	12		
July 12	12 31	7459	+21	248	+7	22	48	7	P	Do.
		7455	+65	292	−4	65	291	3		
				(227)	(+4)		339	10		
July 13	10 42	7459	+33	248	+7	34	36	5	VG	Do.
		7460	+44	259	−7	46	24	2		
		7455	+80	295	−4	80	291	1		
				(215)	(+4)		351	8		
July 14	8 30	7459	+47	350	+8	47	18	2	G	Mt. Wilson.
		7460	+61	264	−7	62	6	1		
				(203)	(+4)		24	3		
July 15	10 38	7461	−53	136	−10	55	97	7	VG	U. S. Naval.
		7463	+61	250	−1	61	12	1		
		7462	+77	266	−9	77	97	5		
				(189)	(+4)		206	13		

POSITIONS, AREAS, AND COUNTS OF SUNSPOTS FOR JULY 1942—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1942	h m		°	°	°	°				
July 16	10 38	7461	−39	136	−10	42	121	12	G	U. S. Naval
				(175)	(+4)		121	12		
July 17	11 21	7461	−24	138	−10	25	48	7	F	Do.
		7464	−22	140	+10	23	12	2		
		7464	−15	147	+10	16	6	1		
				(162)	(+5)		66	10		
July 18	8 32	7464	−3	147	+9	5	6	2	VG	Mt. Wilson.
		7465	+51	201	−2	52	12	2		
				(150)	(+5)		18	4		
July 19	11 15	7465	+67	202	−3	68	24	1	G	U. S. Naval.
				(135)	(+5)		24	1		
July 20	10 57	7466	+42	164	−13	46	145	11	G	Do.
				(122)	(+5)		145	11		
July 21	12 46	7466	+56	164	−12	58	121	7	F	Do.
				(108)	(+5)		121	7		
July 22	10 39	(*)	−24	72	−15	30	6	3	F	Do.
		7466	+70	166	−12	71	145	10		
				(96)	(+5)		151	13		
July 23	10 47	7466	+85	168	−12	85	24	3	G	Mt. Wilson.
				(83)	(+5)		24	3		
July 24	8 37				No spots				VG	Do.
July 25	11 24	7467	−80	336	−4	80	24	1	P	Do.
		(*)	−47	9	−2	48	6	1		
		(*)	−16	40	+12	18	12	1		
				(56)	(+5)		42	3		
July 26	12 24	7467	−65	337	−3	65	48	3	F	U. S. Naval.
				(42)	(+5)		48	3		
July 27	11 54	7467	−52	337	−3	53	48	1	F	Do.
		7468	−3	26	+4	3	24	4		
				(29)	(+5)		72	5		
July 28	10 41	7469	−78	298	−2	78	194	1	G	Do.
		7467	−39	337	−3	40	48	9		
		(*)	+2	18	+19	14	12	2		
		(*)	+10	26	+18	17	12	1		
				(16)	(+5)		266	13		
July 29	10 34	7470	−79	284	+16	79	48	1	G	Do.
		7469	−66	297	−2	67	194	1		
		7467	−25	338	−3	27	24	3		
				(3)	(+6)		266	5		
July 30	10 36	7470	−66	284	+16	66	73	5	VG	Do.
		7469	−52	298	−2	53	194	1		
		7467	−11	339	−3	15	24	4		
				(350)	(+6)		291	10		
July 31	13 27	7470	−52	283	+16	52	73	1	VG	Do.
		7469	−37	298	−2	38	194	5		
				(335)	(+6)		267	6		

Mean daily area for 31 days = 214

* Not numbered.
VG = very good; G = good; F = fair; P = poor.

PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR JUNE 1942

[Based on observations at Zurich. Data furnished through the courtesy of Prof. W Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

June 1942	Relative numbers	June 1942	Relative numbers	June 1942	Relative numbers
1	0	11	7	21	*a* 27
2	8	12	0	22	*a* 19
3	8	13	0	23	17
4	8	14	10	24	15
5	0	15	8	25	20
6	*Mac* 14	16	*d* 8	26	14
7	15	17	10	27	*Wc* 20
8	13	18	14	28	11
9	10	19	*Mc* 31	29	0
10	8	20	25	30	0

Mean, 30 days=11.3

a=Passage of an average sized group through the central meridian.
b=Passage of a large group through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity; *E*, on the eastern part of the sun's disk; *W*, on the western part; *M*, in the central circle zone.
=Entrance of a large or average-sized center of activity on the east limb.

PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR JULY 1942

[Based on observations at Zurich, except at Locarno on July 20. Data furnished through the courtesy of Prof. W. Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

July 1942	Relative numbers	July 1942	Relative numbers	July 1942	Relative numbers
1	0	11	16	21	13
2	*Mc* 18	12	10	22	11
3	*a* 19	13	29	23	0
4	*Ec* 24	14	0	24	0
5	49	15	*Ec* 19	25	0
6	50	16	19	26	8
7	*a* 43	17	18	27	8
8	34	18	8	28	*d* 17
9	31	19	7	29	23
10	19	20	**Wc* 17	30	25
				31	17

Mean, 31 days=17. 8

*=Observation at Locarno.
a=Passage of an average sized group through the central meridian.
b=Passage of a large group through the central meridian.
c=New formation of a group developing into a middle sized or large center of activity; *E*, on the eastern part of the sun's disk; *W*, on the western part; *M*, in the central circle zone.
d=Entrance of a large or average sized center of activity on the east limb.

Chart I.—Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, July 1942

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, July 1942

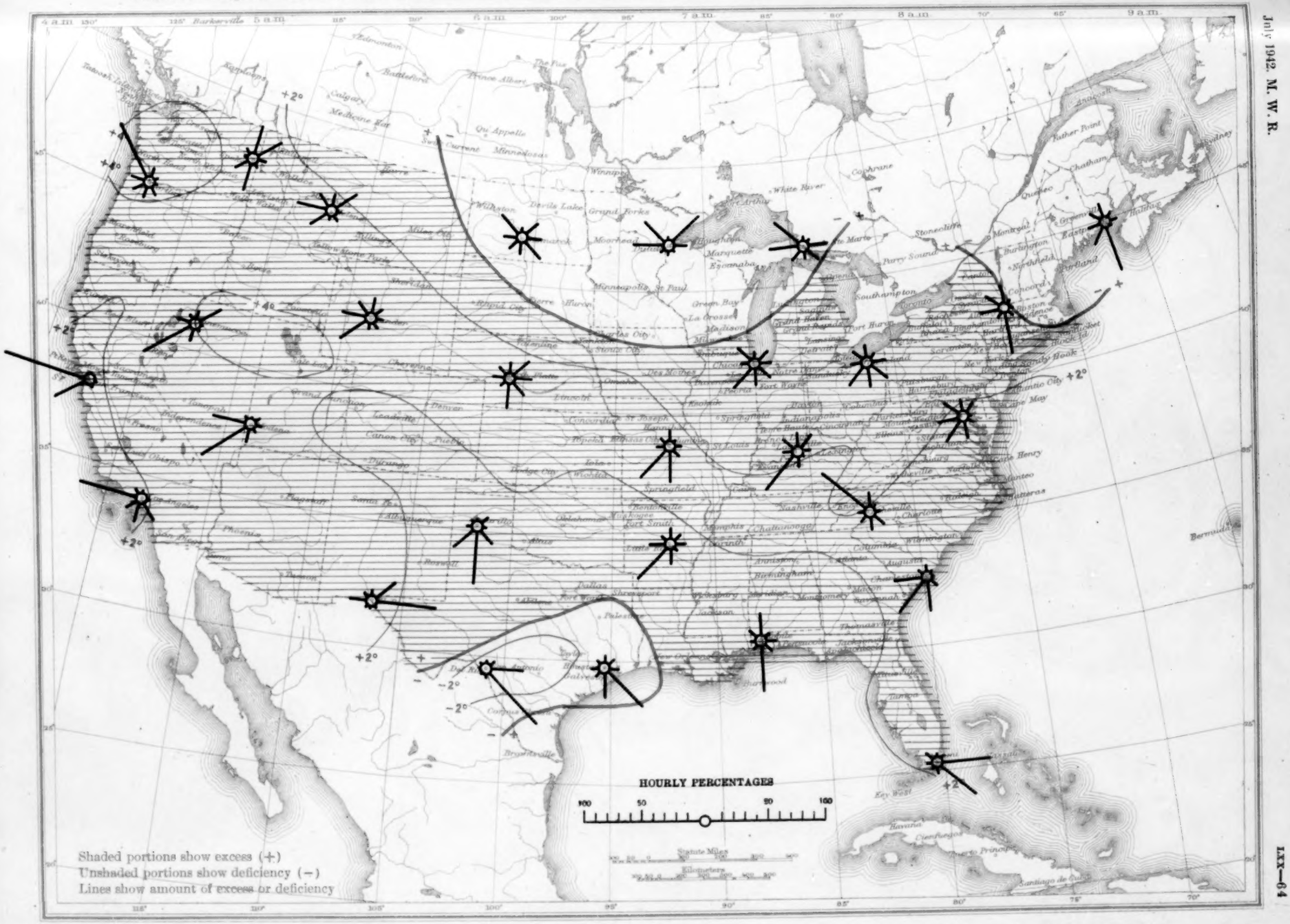
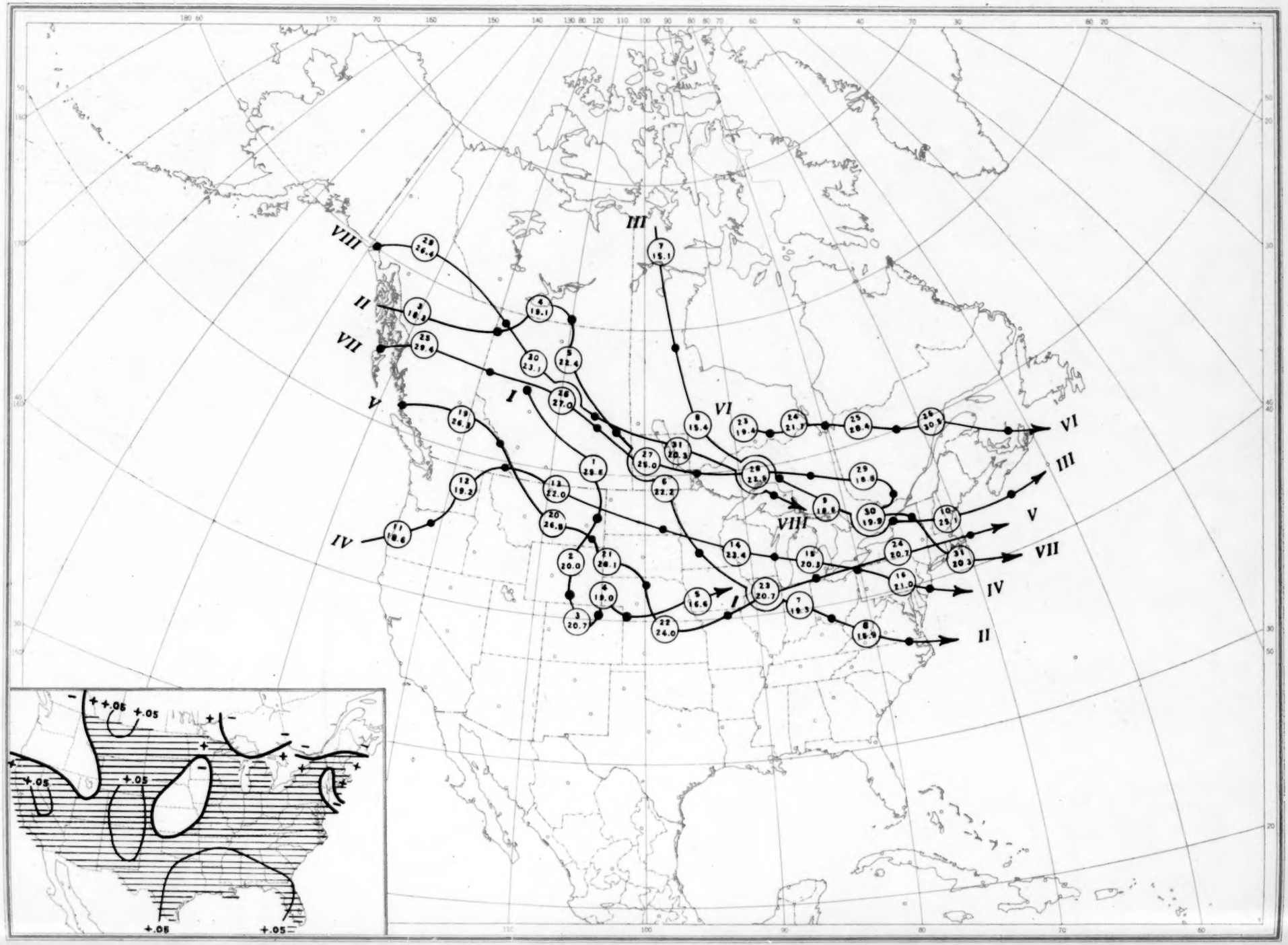


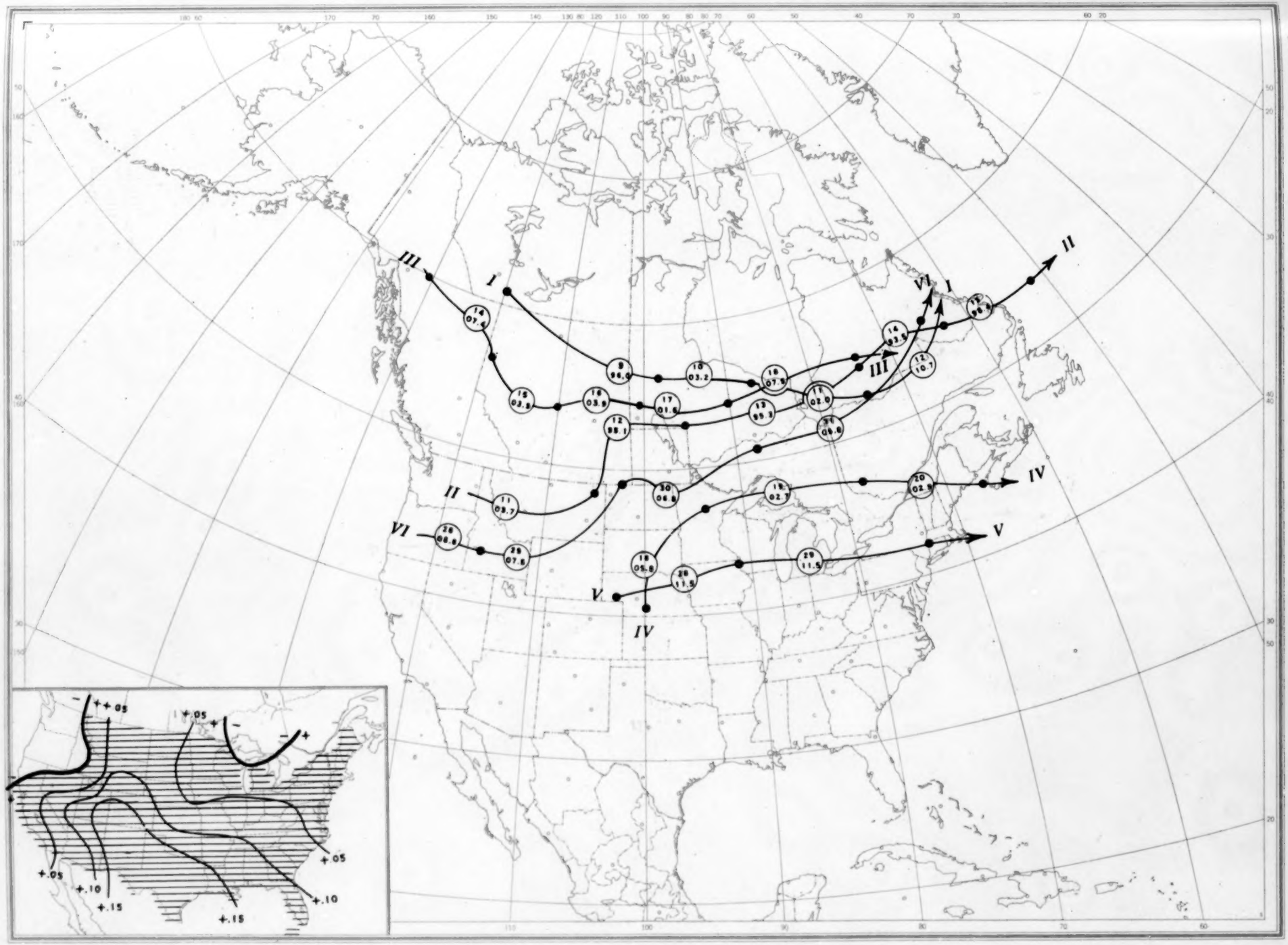
Chart II. Tracks of Centers of Anticyclones, July 1942. (Inset) **Departure of Monthly Mean Pressure from Normal**



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, July 1942. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, July 1942

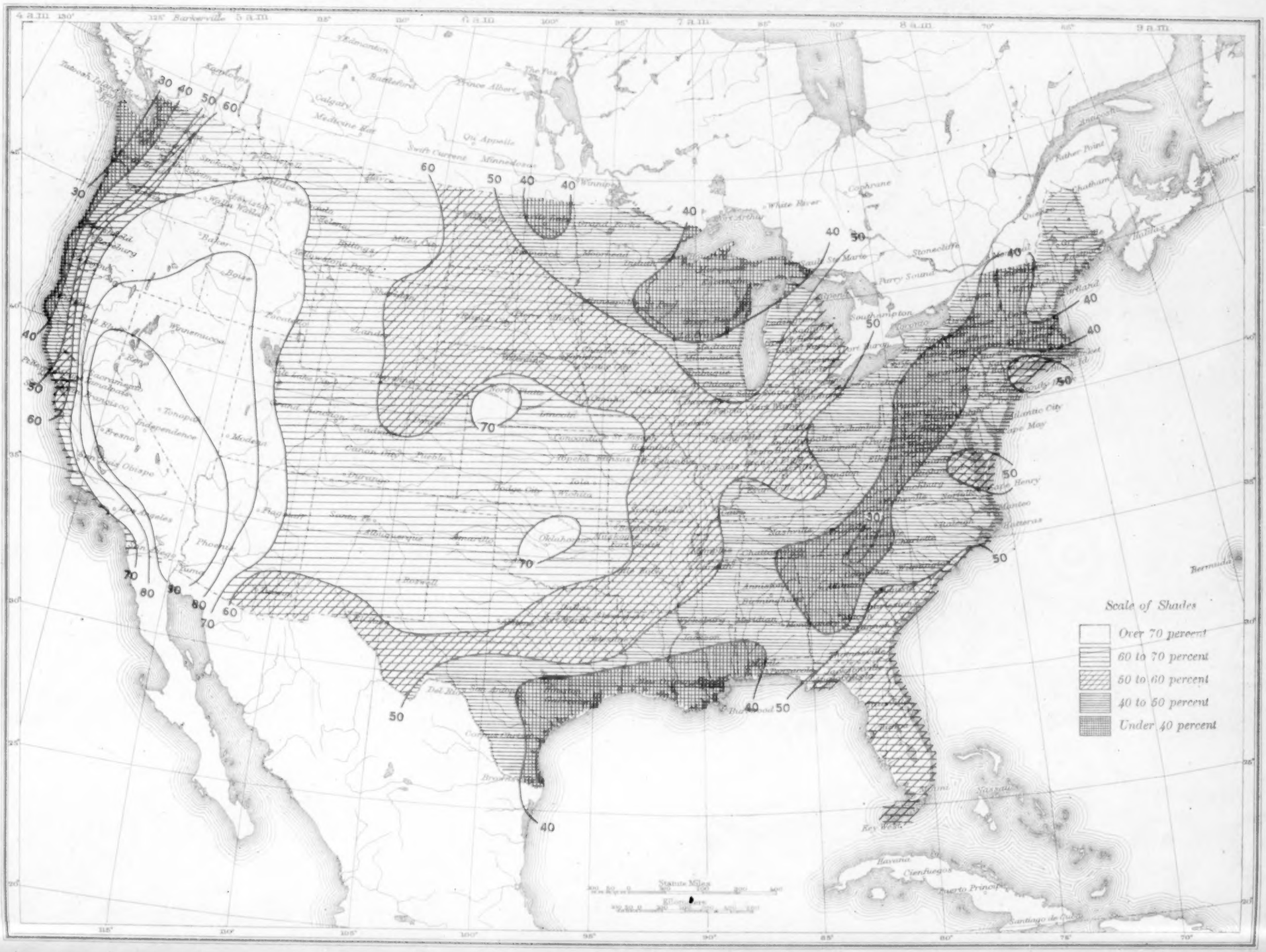


Chart V. Total Precipitation, Inches, July 1942

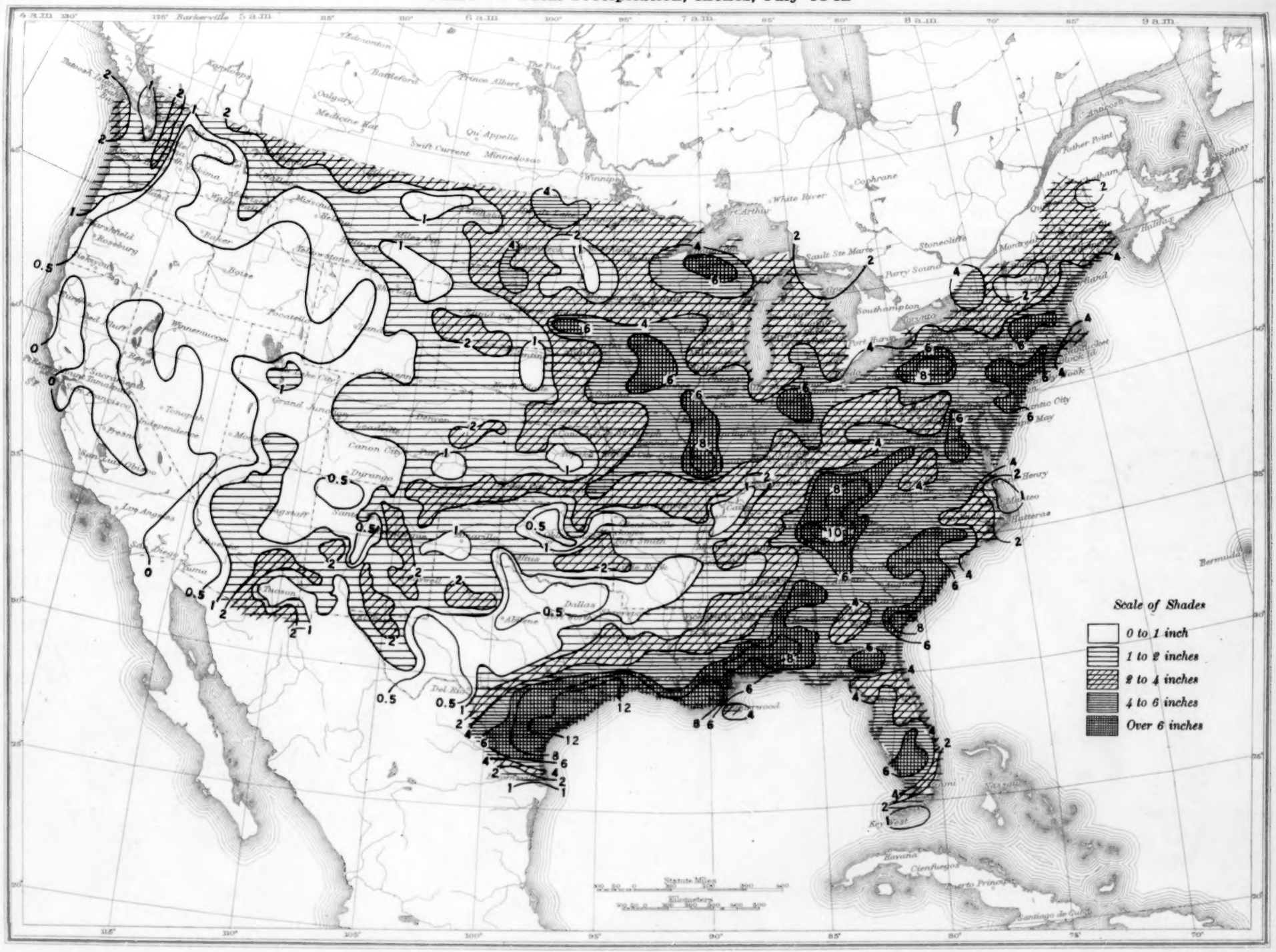


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, July 1942

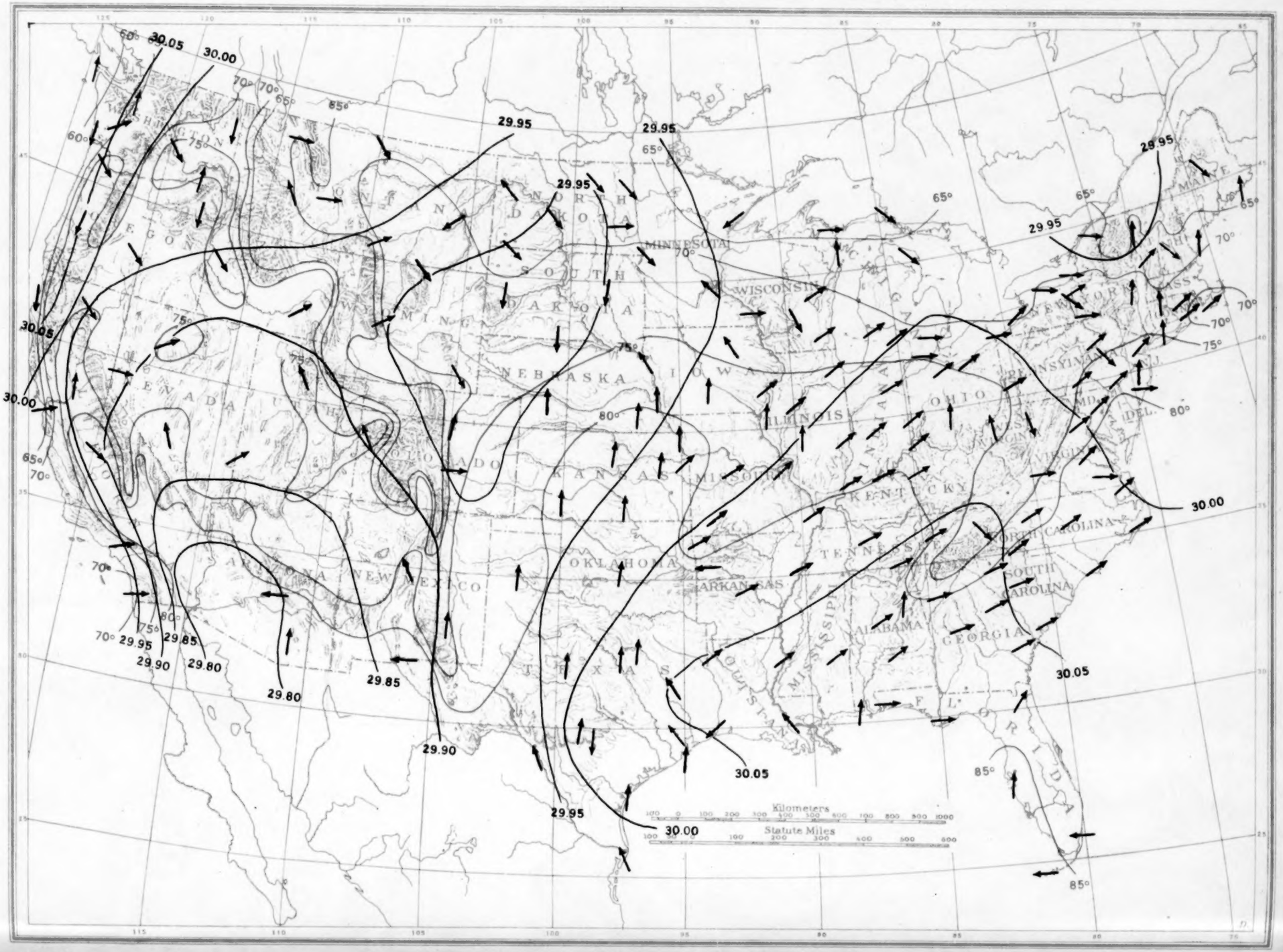


Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) July 1942

Isobars and isotherms based on radiosonde observations at 11:00 p. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

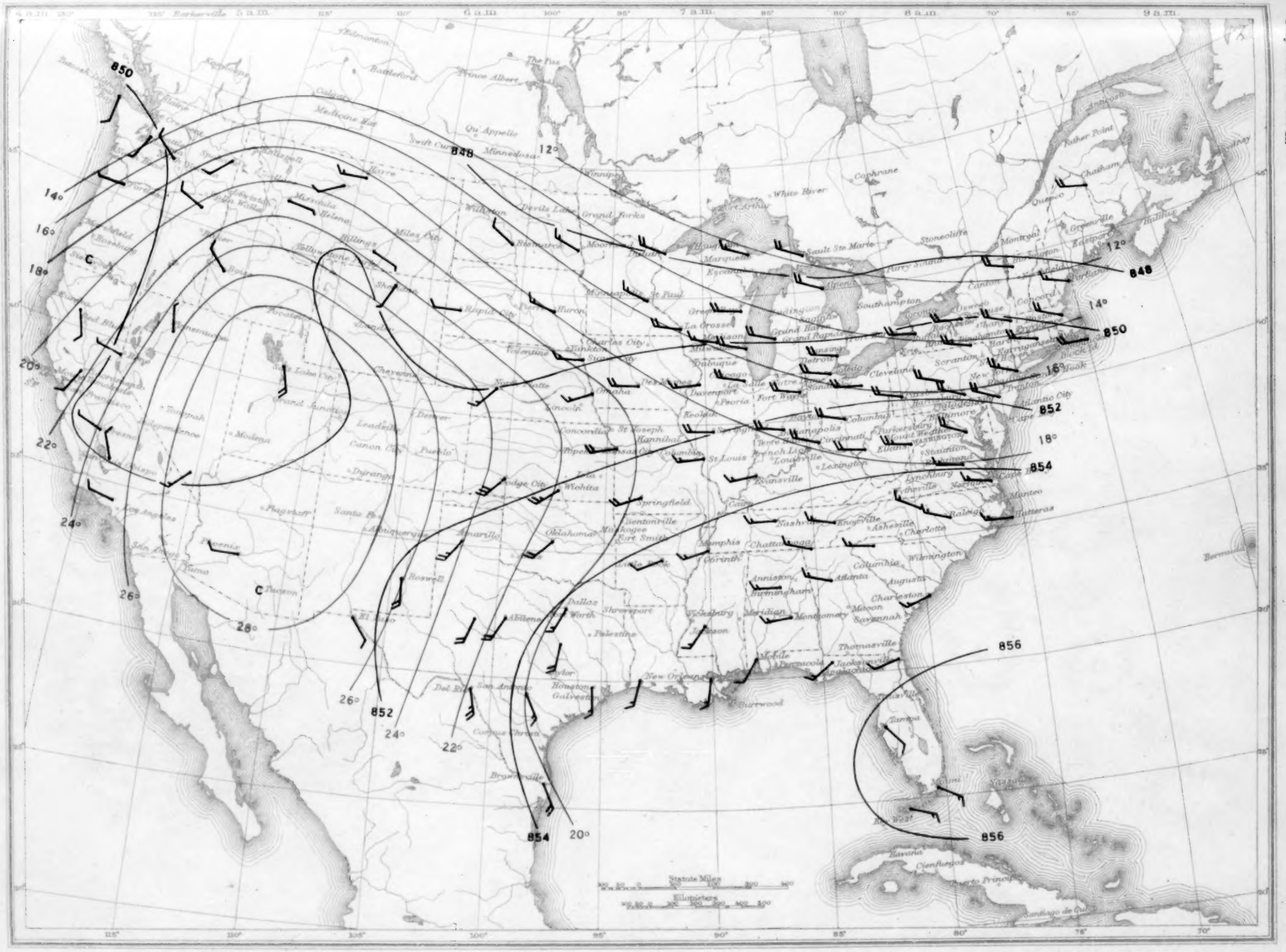


Chart IX. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T) and Resultant Winds 5:00 a.m. (E.S.T.) for 3,000 Meters (m.s.l.) July 1942

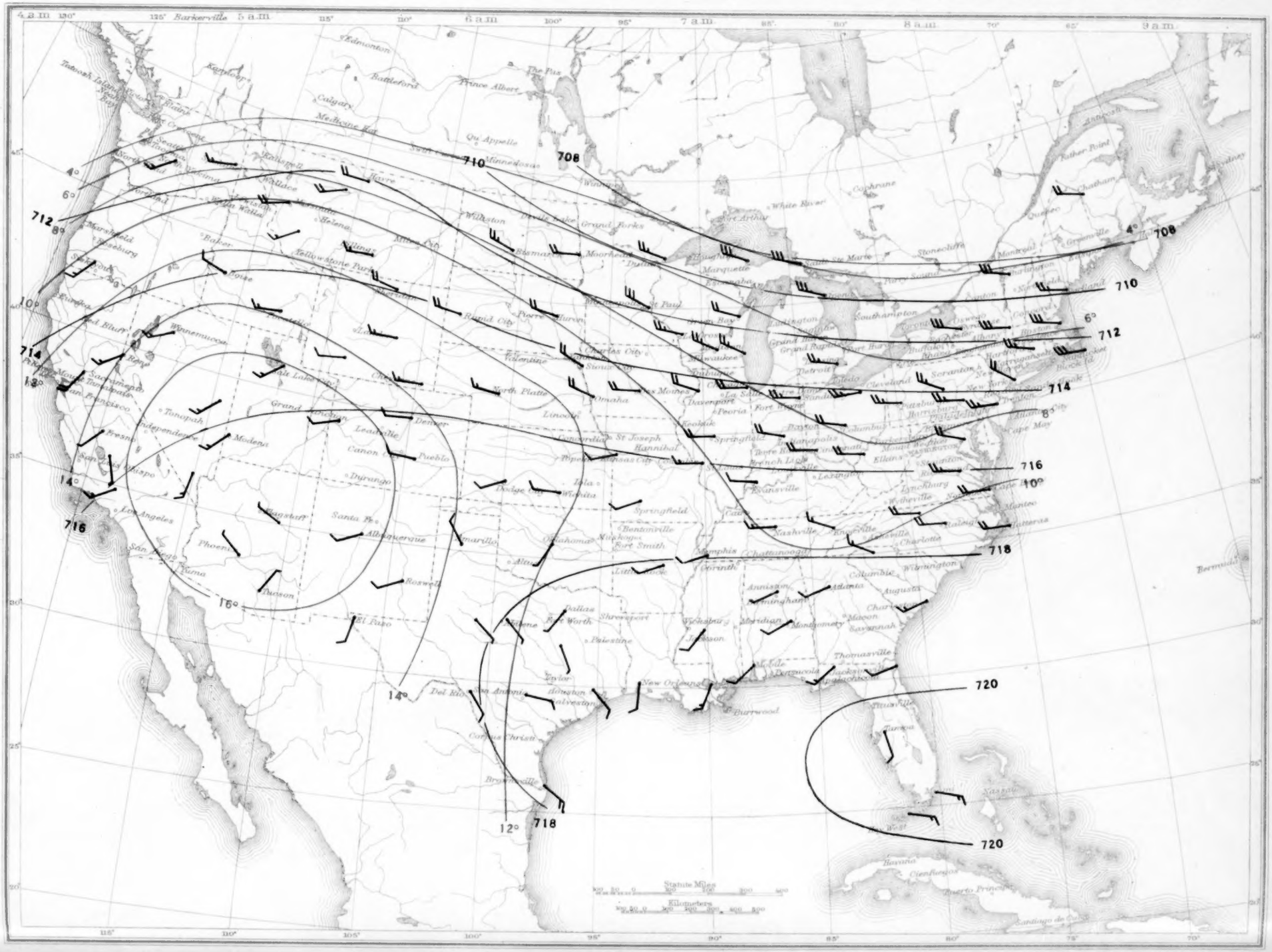


Chart X. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 5,000 Meters (m.s.l.) July 1942

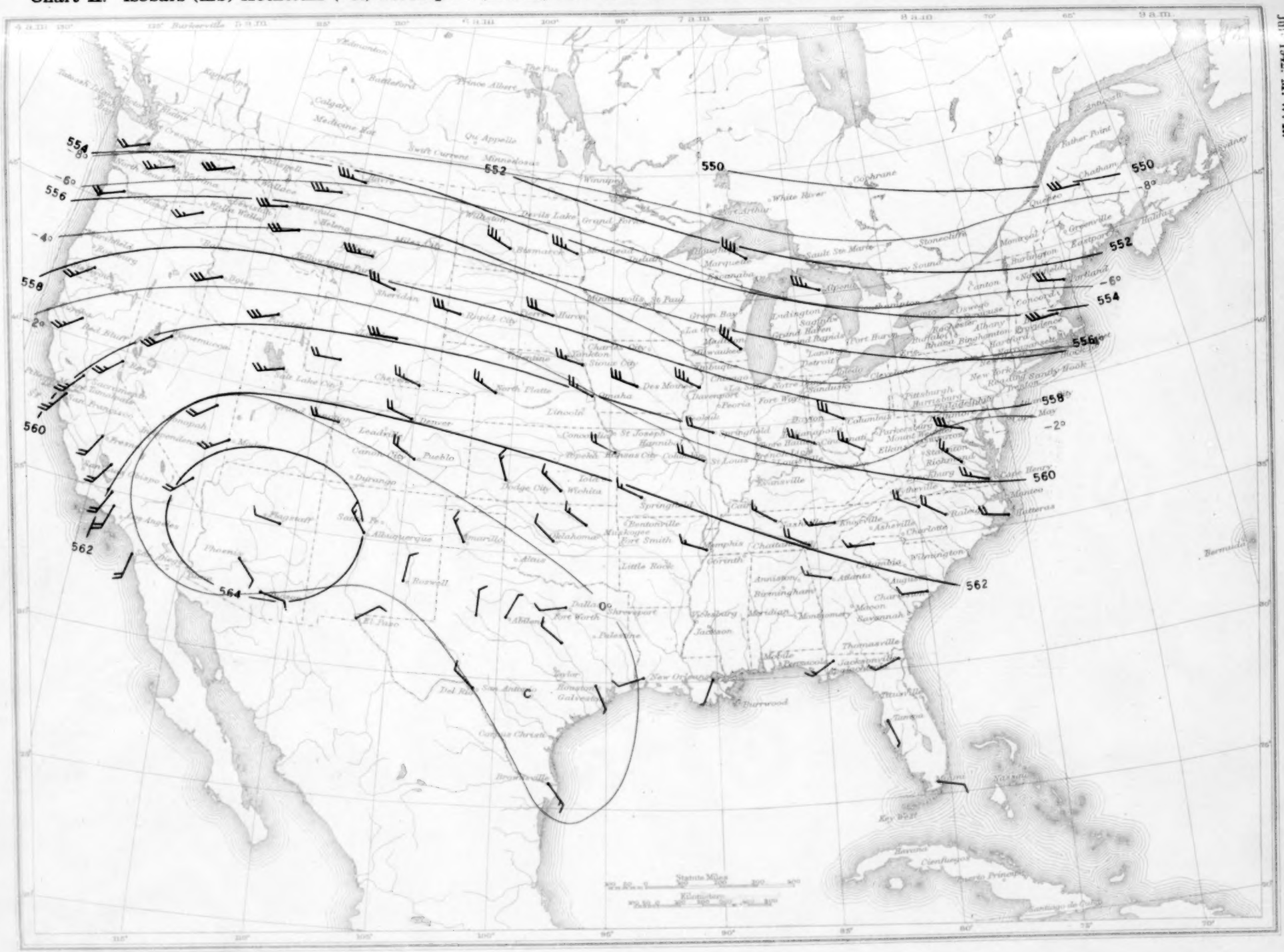
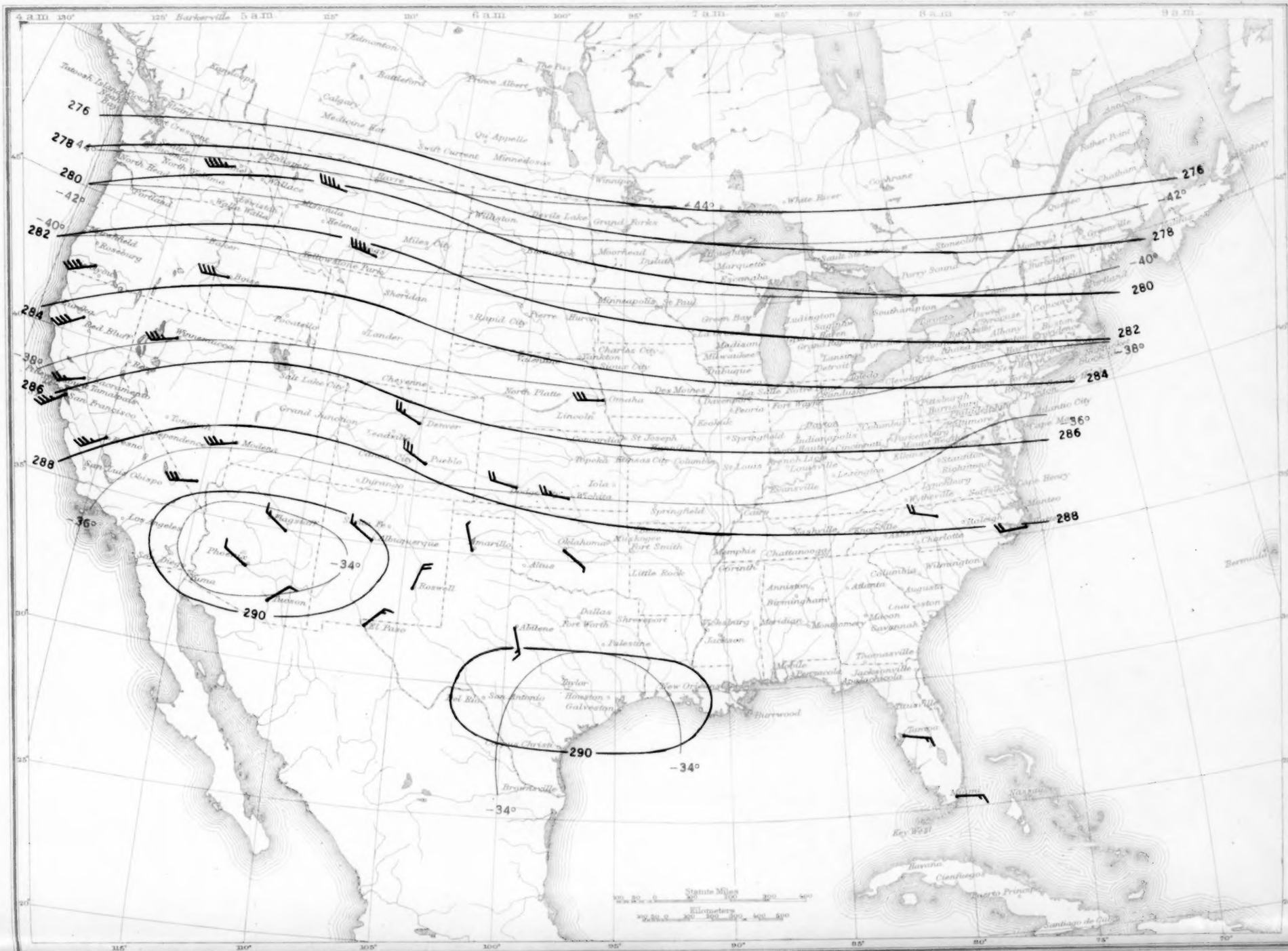



Chart XI. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 10,000 Meters (m.s.l.) July 1942